MUS
4590
.2

Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. L. No. 1.

JAMAICAN FOSSIL ECHINI.

BY
BENJAMIN WALWORTH ARNOLD AND HUBERT LYMAN CLARK.

WITH DESCRIPTIONS OF NEW SPECIES OF CAINOZOIC ECHINOIDEA.

By HERBERT L. HAWKINS.

WITH TWENTY-TWO PLATES.

CAMBRIDGE, U. S. A.:
Printed for the Museum.
October, 1927.

ERRATA.

Page 3, line 24 for "has" read "have"
" 5 " 10 " "on" read "in"
" 8 " 31 omit "and"
" 9 " 30 for "H. L. Clark" read "Arnold and Clark"
" 13 " 15 " " " " " " " " "
" 14 " 1 " " " " " " " " "
" 15 " 16 " " " " " " " " "
" 17 " 29 " " " " " " " " "
" 18 " 30 " " " " " " " " "
" 20 " 31 " " " " " " " " "
" 21 " 22 " " " " " " " " "
" 23 " 2 " " " " " " " " "
" 23 " 26 " " " " " " " " "
" 26 " 29 " "Egozone" read "Egozeue"
" 28 " 21 " "H. L. Clark" read "Arnold and Clark"
" 29 " 11 " " " " " " " " "
" 30 " 34 " " " " " " " " "
" 33 " 1 " " " " " " " " "
" 33 " 27 " " " " " " " " "
" 34 " 13 " " " " " " " " "
" 35 " 4 " " " " " " " " "
" 35 " 22 " " " " " " " " "
" 38 " 27 " " " " " " " " "
" 39 " 13 " " " " " " " " "
" 39 " 31 " " " " " " " " "
" 40 " 19 " " " " " " " " "
" 41 " 4 " " " " " " " " "
" 41 " 25 " " " " " " " " "
" 42 " 12 " " " " " " " " "
" 43 " 1 " " " " " " " " "
" 43 " 25 " " " " " " " " "
" 44 " 20 " " " " " " " " "
" 45 " 4 " " " " " " " " "
" 47 " 26 " "grew" read "grows"
" 47 " 28 " "H. L. Clark" read "Arnold and Clark"
" 49 " 1 " " " " " " " " "
" 50 " 21 " " " " " " " " "
" 51 " 11 " " " " " " " " "
" 52 " 1 " " " " " " " " "
" 53 " 7 " " " " " " " " "
" 53 " 26 " "greater" read "a greater"
" 55 " 18 " "H. L. Clark" read "Arnold and Clark"
" 56 " 27 " " " " " " " " "
" 58 " 1 " " " " " " " " "
" 58 " 30 " " " " " " " " "
" 59 " 20 " "posterior" read "the posterior."
" 59 " 28 " "H. L. Clark" read "Arnold and Clark"
" 61 " 1 " " " " " " " " "
" 61 " 21 " " " " " " " " "
" 63 " 32 " " " " " " " " "
" 65 " 10 " " " " " " " " "
" 65 " 26 " " " " " " " " "
" 67 " 1 " " " " " " " " "
" 68 " 8 " " " " " " " " "
" 68 " 28 " " " " " " " " "
" 69 " 28 " " " " " " " " "
" 70 " 15 " " " " " " " " "
" 71 " 1 " " " " " " " " "
" 71 " 27 " " " " " " " " "
" 72 " 19 " " " " " " " " "
" 74 " 29 " " " " " " " " "
" 75 " 15 " " " " " " " " "

EXPLANATION OF PLATES.

Of plate 1, lines 4, 6, 10, 14 for "H. L. Clark" read "Arnold and Clark"
" " 2 " 2, 6, 10 " " " " " " " " "
" " 4 " 9, 13, 17, 21, 25 " " " " " " " " "
" " 5 " 2, 6, 17, 21, 25 " " " " " " " " "
" " 6 " 2, 6, 10, 14, 18, 22 " " " " " " " " "
" " 9 " 2, 7, 13, 19 " " " " " " " " "
" " 10 " 2, 6 " " " " " " " " "
" " 11 " 8, 12, 16, 20 " " " " " " " " "
" " 12 " 2, 10, 14 " " " " " " " " "
" " 13 " 2, 6, 11 " " " " " " " " "
" " 14 " 2, 6, 10, 14 " " " " " " " " "
" " 15 " 2, 4 " " " " " " " " "
" " 18 " 2, 6, 9 " " " " " " " " "
" " 19 " 2, 4 " " " " " " " " "
" " 20 " 8, 10 " " " " " " " " "
" " 21 " 2, 5 " " " " " " " " "

Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. L. No. 1.

JAMAICAN FOSSIL ECHINI.

BY
BENJAMIN WALWORTH ARNOLD AND HUBERT LYMAN CLARK.

WITH DESCRIPTIONS OF NEW SPECIES OF CAINOZOIC ECHINOIDEA.

By HERBERT L. HAWKINS.

WITH TWENTY-TWO PLATES.

MCZ
LIBRARY
MAY 23 2007
HARVARD
UNIVERSITY

CAMBRIDGE, U. S. A.:
Printed for the Museum.
October, 1927.

JAMAICAN FOSSIL ECHINI.

PREFACE.

This Memoir is based on the collection of fossil Echini made in Jamaica by the senior author in 1922, 1924 and particularly in 1926. It is by far the largest collection of fossil Echini that has been made in the West Indian region and contains more than three thousand specimens, representing seventy species, of which fifty are considered new. It has required six new genera for species so remarkable that they could not be placed elsewhere, or to receive groups of species whose independent status is made clear by the abundance of the material. Several genera (Echinolampas, Eupatagus, Macropneustes, Plagiobrissus) are very heterogeneous groups, containing either large numbers of species requiring careful revision, or a lesser number of imperfectly known, but probably unrelated, forms.

As only fifteen species of fossil Echini, not in this collection, are known from Jamaica, it is desirable to include them and thus make this Memoir a complete account of the fossil sea-urchins of Jamaica so far as they are known.

The generous attitude of Prof. Herbert L. Hawkins, of Reading University, has encouraged this plan. Professor Hawkins, when he heard of this proposed publication, not only abandoned one of his own, but sent descriptions, photographs, and even paratypes of his new species to facilitate our study. In order to validate his new species and their holotypes in the British Museum, and in appreciation of his disinterestedness, his descriptions and figures are included in this Memoir. Professor Hawkins also sent a manuscript list of all the Jamaican Echini known to him, and this list has been of very great service.

It is of course to be regretted that neither of the present authors is a geologist, so that the stratigraphical relationships of the numerous species has been virtually ignored. But owing to the small area and the comparatively simple and well-known geology of Jamaica, this is not a serious matter. Moreover so large a proportion of material was collected from hillsides, banana fields, debris at the base of cliffs, and stream beds, its stratigraphical relationship was more or less uncertain. It is hoped that the descriptions and figures will be adequate for the identification and placement of any material.

In the following pages the identification of the material and the descriptions of the new species, as well as the discussions regarding genera, the keys, and all taxonomic matter, are the work of the junior author. The introduction and all

data regarding the origin and localities of the specimens, and all matter concerning collecting conditions, places, and methods are the contribution of the senior author.

Prior to 1923 almost nothing was known of the fossil Echini of Jamaica. Jackson (1922. Carnegie Inst. Wash., Publ. 306) listed four species as known to him from the island and also mentioned unidentified species of the genera Eupatagus and Paraster; he further stated that R. T. Hill had collected or seen specimens of Acrocidaris, Salenia, Diplopodia, Scutellina, Echinanthus, Echinolampas, Pygorhynchus, and Macropneustes. Obviously this material was only superficially examined and the identifications no doubt need revision. In 1923, Hawkins published (Geol. mag., **60**, p. 199–216) his first contribution to Jamaican paleontology based on "a small collection of Echinoids" "collected from horizons reputed to be Cretaceous" by Dr. C. T. Trechmann. This paper lists three species, all new, and refers to unsatisfactory material representing at least three additional forms. A year later (1924, Geol. mag., **61**, p. 312–324) Hawkins published a second paper based on further collections of Dr. Trechmann. In this he lists five definitely determined species, four partially determined, and eight referred more or less certainly to their respective genera. In his manuscript list (1926), which includes species occurring in the more recent collections of Dr. Trechmann and Dr. C. A. Matley, he lists twenty-three species definitely, five others with some doubt as to identifications, and three others whose identity beyond genus is not suggested — a total of thirty-one forms. The Arnold collection, with its seventy species, has thus considerably more than doubled the known fauna, in this restricted group; indeed the number is nearly tripled, for this Memoir lists eighty-five species, nearly all of which are definitely named.

For the present the senior author is retaining the holotypes of the new species, but as these have been given by him to the M. C. Z. we include not only the Arnold collection number but the M. C. Z. number as well. Wherever possible paratypes of the new forms are already deposited in the M. C. Z.

Just as this Memoir was completed, an important paper, Los Equinodermos Fosiles de Cuba by Dr. Mario Sanchez Roig (1926. Bol. de minas, Habana, no. 10, p. 1–180), has been received. It is surprising to note how few of the Jamaican species are found in Cuba. Apparently the fossil echinoid faunae of the two islands are remarkably unlike.

INTRODUCTION.

Jamaica, in a general way, consists of a volcanic and Cambrian base, capped by formations of fairly recent origin. These formations have apparently been subjected at various times to great lateral pressure, which has frequently folded up and overlapped the strata, thus confusing horizons otherwise easily recognized. The island is blanketed quite generally by earth and a profusion of vegetation, thus covering the fossil-bearing rock. In the more mountainous regions there are a few escarpments, at the base of which fossil Echini are found in rock debris. There are also cliffs and steep hillsides of disintegrated strata, where they may be found. Occasionally, they may be seen exposed on one of the hard formation cliffs which has withstood the destructive action of Jamaica's intense vegetation, but such specimens are almost impossible to secure in good form from the hard flinty bed-rock.

The two thousand miles of usable motor roads in Jamaica are probably unique in the fact that outside of the city of Kingston no straight level stretch of road two miles long exists. These roads lead constantly and windingly over mountains and hills. The roads have multitudes of rock cuts, which continually indicate the character of the rock and its possibilities, and thus enable the collector to examine the various formations, and gradually to know where fossil Echini may or may not be found. Specimens are, however, usually dissociated from original strata.

Jamaica's nine hundred thousand Negro population has been well handled by the government and beggars seldom, if ever, are seen. When a man or a woman, young or old, is in need of assistance, the local highway officer assigns the individual to a heap of stones at the side of the road, on which, with a small hammer in hand, he or she sits breaking fossil-bearing stone into road sizes for a remuneration of approximately fifteen cents for a bushel of properly cracked stone. This method is ideal, as it enables people to buy supplies and automatically furnishes an abundance of splendid road-stone, which accounts for Jamaica's excellent though narrow motor roads.

The collector of fossil Echini in Jamaica may well start his work by talking with, here and there, a more intelligent-looking man or woman perched on the top of a pile of stone beside the road. The collector will find it difficult, if not impossible, to explain his requirements by words, and he should consequently be armed with illustrations or specimens, which will occasionally recall to the mind of the stone-cracker the very object which he or she has broken to pieces a few minutes

before. It will be well to use the phrase "stone sea-eggs," which is generally understood by the people living near the seashore.

The collector will generally be disappointed at the results of his conversations, but sometimes he will be delightfully surprised, especially after two or three interviews with an intelligently interested Jamaican Negro.

Having become familiar with the formations in which fossil Echini might occur, it is a simple matter for the collector to stop his car where road-stone is being prepared from such formation, and he will soon recognize the facial expression by which the Negroes show that they comprehend his desire to secure specimens of "stone sea-eggs."

It must not be supposed that fossil Echini are scattered with any regularity throughout any special geological formation, and successful results in securing specimens will come from a process of elimination, by which certain areas will be eliminated as non-productive where other areas, probably in higher elevations (except in the Blue Mountains), will show good results.

The experience of the senior author indicates that the western end of the island is more prolific in fossil Echini than any other general section, although the Eocene hilltops which generally bound the cockpit hills of St. Ann, Trelawny, and St. James Parishes may at any point produce excellent results. The Cambridge sector with the railway to the south and east and the Great River in the center, extending from approximately Stonehenge on the south to Montpelier on the north, has many excellent Echini-bearing areas, including the region from Catadupa to Cambridge, where good results may be expected. The gravel banks of the Great River at low water, with the assistance of one or two bright boys, may yield many interesting specimens, which, by finding others, might gradually be traced to their own particular hill environment. The new species, *Phymosoma peloria*, was first secured by a boy in this region, who, when asked about stone sea-eggs, inquired whether they are the round stones with rough, dull points which he and other boys had often used as "rubbing" stones when they bathed in the pools of the Great River.

From Montpelier westward to Green Island and northward to Lucea, the country abounds with exceedingly inviting prospects for fossil Echini, particularly from the Flint River westward, but so far as known there have been no promising results obtained, except in two areas — one Abingdon, near the shore, and the other, a few miles south of Green Island. There can, however, be no doubt that fossil Echini abound at many points within a radius of twenty miles of Lucea.

Following eastward and toward the south side of the island, the collector will

probably find it desirable to keep in close touch with the south side of the cockpit country, the edge of which, and doubtless considerable of the central portion, seems to be blanketed by various formations in which fossil Echini frequently occur. Continuing eastward to Chapelton, specimens of large average size at or near the railway rock-cuts a little south and east of the town have been obtained.

From Chapelton eastward to Kingston via the southern highways (except at the north end of Bogg Walk) there seem to be no indications of fossil Echini, but to the east and north, on the Claremont road, the formations seem very inviting. So far as known, however, collecting has not been attempted in that area.

Claremont is situated on a bed of marl or very soft Eocene rock, in which remarkable casts of marine shells are abundant, but several hours of earnest search failed to reveal any direct evidence of fossil Echini. A number of the gardens at Claremont have flower beds bordered by large flat casts taken from the adjoining marl beds, some of these casts being at least ten inches across and an inch to an inch and a half thick. It seems tantalizing that these beds apparently lack fossil Echini, but possibly research will find areas in that region which will be prolific in some forms of echinoids.

From Claremont eastward, the country is not favorable until you approach the White River which, with the Rio Nova, drains a large area where echinoids are found on various hillsides, sometimes abundantly.

From Lucky Hill southward between the head waters of the two rivers is excellent ground and many interesting specimens in the present collection were obtained in that area. The gravel beds in the river near Pembroke Hall also contain echinoids. There are hills two to five miles northeast of Guys Hill in the region of Decoy and Caron Hall, and northward toward Donnington Castle, where fossil Echini are probably abundant on the rather bare tops and higher slopes.

Southward toward Kingston, for a considerable distance, the formation is of igneous origin. Nearer Kingston the rock-cuts and quarries fail to indicate echinoids.

Seven or eight miles east of Kingston a poor road extends about two miles northeasterly from the shore highway to an interesting waterfall. Just before reaching the waterfall, the road branches to the right and almost immediately comes into a region with considerable broken and eroded rock, which will probably be an excellent district for fossil Echini.

At the eleven mile post east of Kingston, the Yallahs River road turns off at the left for Moy Hall and Arntully, while the main road leads south and eastward to Trinityville, Morant Bay or Bath. As this road meets the Yallahs River three

or four miles after leaving the fork, it comes down a hillside of fossil-bearing rock, in which fossil Echini are found. At the foot of this slope the road continues along the west side of the river and proceeds up the hills for two or three miles after crossing the river. Proceeding north about a mile and a half, the road passes over about one half mile of new highway constructed in the winter of 1926 to avoid river fords previously used. Near the south end of this new road a rock-cut exposes an extremely interesting sample of vertical strata caused by horizontal pressure. They are very regular in form, sharp in detail, and clearly visible in the new rock cutting.

The Yallahs River region includes probably a smaller amount of the more easily eroded formations than Lucky Hill and the region bordering on the cockpit hills westward, and consequently the material secured tributary to the Yallahs is more defective than similar specimens obtained in the western area.

Proceeding up the Yallahs, the road turns sharply eastward a mile east of Moy Hall, where the view is delightful, but fossil-bearing rock is not apparent. Turning eastward, the road descends to within six or seven miles of Bath through areas which seem to lack fossils. Throughout these latter miles, however, the formations of both rock and earth very often suggest fossil Echini and it is probable, if not certain, that the hillsides on the north side of the river will yield abundant specimens to the collector, who, with headquarters at the little hotel at Bath Hot Springs, will work for a few days on the upper hillsides to the westward along the north side of the river.

The drive from Bath to the end of the island and thence westward to Port Antonio gives no suggestion of fossil Echini unless in the quite modern coral and shell conglomorates at or near the water's edge. At Port Antonio may be found interesting species of recent Echini, but the fossils, if any, are probably quite high up in the hills to the southward.

Westward from Port Antonio the road keeps near the shore, where it cuts through various points and hillsides, some of which suggest comparatively recent origin, and it is probably as well to continue directly to Gayle, where a few days or a week's work should produce excellent results, and especially, if supplemented a week or two later by another period.

The area from Gayle southward toward Guys Hill will eventually produce many interesting fossil Echini. The rock is soft and many of the hilltop areas are more or less free from the normal growth of vegetation, which generally obscures the eroded rock, where the best specimens of fossil Echini are found.

From Moneague westward, the Claremont marl beds may well take a few hours of the collector's time. From Claremont west to Brownstown, the cockpit

hill formations become apparent and the collector will, from time to time, observe what may be rather narrow intersections of softer strata, extending westward not far from the north edge of the cockpit hills. These are not the strata in which the many caves of the cockpit country generally occur. Although frequently yellowish in color, they may be at times quite dark. They are also not essentially of a shaly character, although varying strata, some quite thin, generally permeate them in a normally lateral direction. This is the typical rock of Jamaica for fossil Echini, and the ideal place to find them is on a hilltop or a hillside where the strata have been eroded or more or less broken and disintegrated by weather exposure. This type of strata seems to occur, generally in rather narrow layers, along the boundary of the cockpit country at an elevation of from 1,200 to 2,500 feet. It is hard to locate and is perhaps most easily traceable by following up the hillside from where water-worn specimens are found in streams. Aside from this, however, the collector should not overlook the fact that hundreds and probably thousands of fossil echinoids are daily crushed by the hammers of the road-stone crackers, who, if their minds can be sufficiently opened, will tell the collector where stones are brought from in which they find fossil sea-eggs. It is, however, very much harder to induce these people to talk than might be supposed; however, one success in this particular line may amply repay very considerable effort.

Aside from these methods of collecting, it is sometimes possible to find fragments of Echini among the debris at the foot of the cliffs, from which the matrix can be traced to strata at higher elevations, but this material is generally difficult to detach from the hard formations of which the cliffs are composed.

CIDARIDAE.

Cidaris foveata Jackson.

1922. Carnegie inst. Wash., Publ. 306, p. 17; pl. 1, fig. 6, 7.

This species, known only from the holotype, is not represented in the present collection. It was collected by R. T. Hill, and recorded as "Jamaica Eocene, from yellowish limestone, probably the Cambridge formation of R. T. Hill."

Cidaris gymnozona [1] H. L. Clark, sp. nov.

Plate 1, fig. 3.

Holotype.— Coll. B. W. A. 3. M. C. Z. 3,261. Base of road-cut west side of road, 700–800 feet beyond Spring Mount, St. James Parish.

[1] γυμνός = *naked* + ζώνη = *belt*, in reference to the bare interporiferous areas.

Test about 35 mm. in diameter and probably rather more than half that in height originally, but now crushed and distorted. Peristome apparently somewhat larger than apical disk in the proportion of about 15 to 12. Coronal plates 7 or 8 in each series; at ambitus a perfect one is 6 mm. high by 8 mm. wide; primary tubercles large, perforate and non-crenulate. Areolae occupying most of surface of plate; scrobicular circle conspicuous, of 12–15 large, well-spaced secondary tubercles; outside the scrobicular circle, there are on each plate only a very few (about 20) small secondary tubercles and about an equal number of miliary tubercles; both inner and outer ends of plate are notably bare, at least in midzone; dorsally, but more especially, orally, miliary tubercles are numerous, covering the plates more completely.

Ambulacra nearly 6 mm. wide in midzone, only slightly flexuous; pores elliptical, wider than high, separated from each other by a space much greater than their own width, but united by a more or less evident shallow furrow; interporiferous area, about as wide as one of the poriferous, with a conspicuous series of tubercles along each margin; between these marginal series the area is quite bare save for a few scattered and insignificant miliary tubercles. There are 13 ambulacral plates abutting on each coronal plate in midzone. Peristome and apical disk, not admitting of description.

Here and there secondary spines and even pedicellariae are present; secondary spines of scrobicular circle, as usual, flat and blunt, about 3 mm. long and .80 mm. wide, while those of ambulacra are about 2 mm. long, .35–.40 mm. wide, and not so flattened; pedicellariae, apparently small tridentate and small globiferous but not at all distinctive, resembling closely those of the Recent species, *Eucidaris tribuloides*.

Although allied to *C. loveni*, *gymnozona* is easily distinguished by the very wide ambulacra, the bare interporiferous areas and the marked difference in tuberculation of the coronal plates.

The type-locality was suggested by Dr. C. T. Trechmann as a possible collecting ground for fossil Echini and six or seven species were found there. The rock-exposures immediately beyond the cut although of similar material do not seem to contain Echini, although there are casts of the large flat shells typical of the marl beds. It seems probable that the Echini found at the base of the cut had rolled down with other fragments and debris from rock-formations further up on the hill.

Cidaris loveni Cotteau.

1875. Kongl. Svens. vet. akad. Handl., **13**, no. 6, p. 10. Jackson, 1922. Carnegie inst. Wash., Publ. 306, p. 19, pl. 1, fig. 8–10.

Plate **1**, fig. 1, 2.

There are sixteen specimens referred to this species, although all are larger than Cotteau's type. The largest is about 52 x 36 mm., while the smallest is 28.5 x 20 mm. All are more or less weathered and several are in very poor condition. In only a few cases do the poriferous areas show clearly the furrows normally connecting the widely separated pores, but there is no reason to doubt that they were uniformly present. The interambulacral areas are fully covered with secondary and miliary tubercles; on the inner third of a coronal plate in the midzone as many as 60–70 such tubercles can be counted. There are 8 coronal plates in each series, even in the smallest specimen, and in a few cases there are 9. There is considerable diversity in the form of the test; one specimen 44 mm. in diameter is only 26.5 mm. high (60%), while another 43.5 mm. in diameter is 33 mm. high (76%). A most characteristic feature of this species, shown by all except the very poorest specimens, is the presence of horizontal lines, like fine parallel scratches, which ornament the median interambulacral areas; there are about 10 on each plate in the midzone. They are not strictly parallel but seem to separate the horizontal lines of small tubercles from each other.

All but one of these specimens were found in the vicinity of Easington, just west of the Yallahs River, on high elevations. They occurred in a hard rock of a light gray color, in which occasionally the spines were visible but there are no spines with these specimens.

A single specimen of a dark yellowish color and hard, smooth texture, was found in earth, on a banana plantation in the region of Seven Rivers, near Great River, not far from Cambridge, St. James Parish. Aside from the superficial differences, this specimen is quite typical. The occurrence of the species at both ends of the island is worthy of note.

Cidaris melitensis Wright.

1855. Ann. mag. nat. hist., ser. 2, **15**, p. 107. Jackson, 1922. Carnegie inst. Wash., Publ. 306, p. 21, pl. 1, fig. 12–17.

There is a single specimen, about 13 mm. in diameter and 7 mm. high, which seems to be a typical example of this species. The apical disk and the peristome are of equal size, each about 5.5 mm. across.

This specimen, the smallest Cidaris found, was picked up by a very small boy

who was too bewilderd to remember where he found it, but its condition indicated soft earth, perhaps the remains of disintegrated strata now cultivated for bananas. Incidentally, earth areas of this kind seem to produce some of the best fossil Echini in Jamaica. Doubtless because the hardness of the fossils withstands destructive elements longer than the residue of the strata and thus the Echini are more conspicuous than they would be if associated with broken rock.

Leiocidaris sp.?

Hawkins (Geol. mag. 1923, 60, p. 205) refers a single interambulacral plate, with its adjoining half-ambulacrum, from the railway cut between Cambridge and Catadupa, to an undeterminable species of Leiocidaris. It is not altogether unlikely that the fragment should be referred to *Cidaris loveni* but Hawkins considers this doubtful.

HEMICIDARIDAE.

Goniopygus supremus Hawkins.

1924. Geol. mag., **61**, p. 313; pl. 18, fig. 1, 2.

A single test, about 24 mm. in diameter and 13.5 mm. high, is unquestionably a Goniopygus and answers well to the description of *supremus* except in a few particulars. These differences seem for the most part to be associated with its smaller size. The test is much more worn than is that of the holotype and the peristomal margin is somewhat broken and defective. But the apical disk, the well-defined periproct and the general tuberculation of the test are unmistakable. Hawkins gives the number of interambulacral and ambulacral plates, per column, as 10 and 65(?) respectively (obviously by ambulacral "plates" he means "elements" as indicated by the pore-pairs); in the present specimen the numbers are 8 and 48(?). A more serious difference is in the character of the ambulacral plates, for Hawkins says the elements form "tetrads," *i.e.* there is "1 tubercle to every 4 pore-pairs"—"even to the ocular margin." In the present specimen the sutures can be seen in many of the plates and they certainly reveal only 3 elements to each plate. The plates are definitely centrechinoid, the median being the largest of the three elements while the adoral is only a demiplate; this is just as Duncan describes the ambulacral plates of Goniopygus. As the sutures were not visible in Hawkins's specimens, the number and arrangement of the elements is not known but it seems improbable that there are really 4. In spite of this apparently important difference this specimen is referred, with little hesitation, to *supremus*.

There are also two other specimens which are referred to this species, but each is in such poor condition that its identity is uncertain. One is so much weathered its characters are almost lost, while the other is worn perfectly smooth by water, but in each case the general appearance of the ambulacra and the apical disk are indicative of Goniopygus. Furthermore these two specimens were collected in the same region as the indubitable specimen, which was found in disintegrated strata near the west branch of the Rio Nuevo, St. Mary Parish, not far from Pembroke Hall. Hawkins's original material was from the west end of the island, near Catadupa, St. James Parish.

CENTRECHINIDAE.

Hebertia simplex Hawkins.

1924. Geol. mag., **61**, p. 317, pl. 18, fig. 4, 5.

A single specimen from Spring Mount, St. James Parish, is recorded by Hawkins. The species is not represented in the Arnold collection.

Stenechinus[1] H. L. Clark, gen. nov.

Type.— *Stenechinus regularis*, sp. nov.

Test small or of moderate size. Ambulacra about half as wide as interambulacra or a little more; poriferous zones very narrow and straight with pores directly superposed, not at all expanded at peristome, though the most adoral pore-pairs may be slightly out of alignment; pores large, separated from each other by a horizontal distance equal to or greater than their own diameter and by a vertical distance equal to or less than that. Ambulacral plates centrechinoid, the middle element largest, the adoral element often failing in the midzone to reach the midradial suture; each plate has a single large perforate primary tubercle close to the pore-pairs, but secondary tubercles are few and scattered or quite wanting. Coronal plates rather numerous, each with a single large perforate tubercle near its center, and some scattered secondaries. Apical system symmetrical, with broad genitals shutting out all the oculars from the large, central, circular periproct. Peristome larger than apical disk, with well-marked gill-cuts.

This genus is near Hebertia, but differs strikingly in the regular and symmetrical apical system, having all the oculars exsert. It is also near Diademopsis, but differs so much in the tuberculation of the test that it seems unwise to refer the material in hand to that genus. There are some resemblances to Echinodiadema and Microdiadema, but the differences far outweigh them.

[1] στένος = *narrow* + ἐχῖνος = *sea-urchin*, in reference to the straight and narrow poriferous zones.

STENECHINUS PERPLEXUS [1] H. L. Clark, sp. nov.

Plate 1, fig. 4–6.

HOLOTYPE.— Coll. B. W. A. 9. M. C. Z. 3,263. Spring Mount region, St. James Parish.

Test 28 mm. in diameter and 19 mm. high; ambitus rounded pentagonal with the ambulacra at the angles; surface of test so worn that only a few tubercles still show their perforate condition, but secondary and miliary tubercles are still quite obvious.

Interambulacra 11 mm. wide at ambitus; coronal plates, 16 in a column; at ambitus they are 6 mm. wide and 2.2 mm. high; in addition to a small primary tubercle, less than a millimeter across the base, there are many secondary tubercles, 7 or 8 on adradial half of plate, 5 or 6 on inner end, and 2 or 3 above primary tubercle, which is at center of plate but nearer lower, than upper, margin.

Ambulacra 6.5 mm. wide at ambitus, tapering almost as much orally as apically; ambulacral plates, 25 in a column, apparently centrechinoid but sutures very hard to distinguish; if the structure is correctly interpreted, the middle element is very much the largest and the aboral as well as the adoral may fail to reach the midline; primary tubercle mainly, if not wholly, on middle element, near its center; only uppermost plate lacks a tubercle; several (6–8) secondary tubercles on each plate at and below ambitus but they are more or less worn and indistinct. Pores large, nearly circular; distance between two pores equals pore-diameter, while vertical distance between pore-pairs is notably less except near apical system; areas between pores of a pair, as well as those between pairs, more or less elevated, giving poriferous zones a rough appearance when compared with following species, but of course the condition now apparent in *regularis* may be due to worn condition of test; pore-pairs in a narrow straight poriferous area, narrowest close to peristome.

Apical disk 7.5 mm. across; genital plates subequal, about as high as wide, with a broadly rounded distal point; pores large, nearly circular, near center of plate; one plate has the whole distal point markedly depressed, forming a hollow over a millimeter across but whether this indicates the position of the madreporite is uncertain; if it is not the madreporite, there is none; genital plates in contact forming a closed ring around the large, nearly circular, periproct, which is 4.5 mm. across; on each genital plate are 4–6 small tubercles arranged along the inner margin. Ocular plates small, pentagonal, wider than high, with pore set back a little from distal margin; all are exsert.

[1] perplexus = *puzzling*, in reference to the difficulty of determining its natural relationship.

Peristome small, only 8 mm. across, very slightly sunken; gill-cuts distinct, much as in *regularis*.

There are three specimens of this species, which, in spite of some superficial differences, seems congeneric with the following; the broader ambulacra, smaller peristome and more abundant small tubercles, added to the rougher surface of the poriferous areas, give it a different general appearance, but in all the really important characters there is a notable similarity. One of the paratypes is 31.5 x 22 mm., but is in very poor condition. The other is of the same diameter but is not quite so high; it is, however, very well preserved. Its most interesting feature is found in the narrow, elongated genital pores, in marked contrast to the large, circular pores of the holotype. It seems highly probable that this is a secondary sexual character.

This fossil was found at both ends of Jamaica, as the holotype is from the western end, while the paratypes are from the mountains on the west side of the Yallahs River below the upper bridge, in St. Thomas Parish.

Stenechinus regularis[1] H. L. Clark, sp. nov.

Plate 1, fig. 7–9.

Holotype.— Coll. B. W. A. 7. M. C. Z. 3,264. Spring Mount region just above Leyden, St. James Parish.

Test 25 mm. in diameter and nearly 18 mm. high; ambitus nearly circular but with indications of a pentagon with rounded corners; surface of test considerably worn so that there are no miliary granules, no ornamentation and only a few widely scattered secondary tubercles. On first examination all tubercles, primary as well as secondary, are low and imperforate, but more careful study shows that the least worn tubercles reveal some indications of a perforation and here and there the condition leaves little doubt that the tubercles were really perforate.

Interambulacra 10.5 mm. wide at ambitus; coronal plates 14 in each column; at ambitus they are 5.5 mm. wide and 2.5 mm. high; in addition to a primary tubercle, whose base is a millimeter across, there are 3 or 4, unequal, irregularly placed secondaries on adradial half of plate and one or two on inner half; primary tubercle near center of plate but somewhat nearer lower than upper margin.

Ambulacra a little over 5 mm. wide at ambitus, tapering more apically that orally; ambulacral plates about 21 in a column, centrechinoid in character, with middle element clearly largest; aboral element low, much narrower at inner than at outer end; adoral element often nearly or quite trigonal and in midzone usu-

[1] regularis = *regular*, in reference to the very regular ambulacra.

ally fails to reach midline; primary tubercle on both middle and aboral elements, near middle, very close therefore to poriferous area; no tubercle on 5 uppermost plates; secondary tubercles rare but one is usually present on inner end of aboral element of plate. Pores large, nearly circular, the two of each pair separated by a distance equal to their own diameter, the pairs themselves separated by a like distance; areas between pairs flat but between pores of a pair slightly elevated; pore-pairs form a narrow and nearly straight poriferous zone, but actinally the pair in each adoral element is slightly nearer the midline, and this position of that particular pore-pair makes certain the centrechinoid nature of the plates, for it prevents considering the adoral element as the aboralmost element of an echinoid plate; at peristome, pores smaller, closer together, so that instead of poriferous areas widening at that point, they actually become narrower.

Apical system 6.5 mm. across; genital plates equal (no madreporite is distinguishable), wider than high, with a rounded distal angle, and pore near center of plate; they are in contact with each other, forming a closed ring around periproct; oculars pentagonal, about as wide as high, with pore close to distal margin; all are exsert. Periproct large, circular, 3.5 mm. across. In its present condition the whole apical disk is quite smooth, but it is evident that there were tubercles on the genital plates, especially along the inner margin.

Peristome, 9 mm. across, not at all sunken, oral surface of test being quite flat; gill-cuts conspicuous on sutures between ambulacra and interambulacra but curving into interambulacra; inner margin conspicuously swollen.

There are eleven specimens of this interesting species but none of the others are in quite so good condition as the holotype. A specimen having the same horizontal diameter is only 16 mm. high; it is so water-worn it is quite smooth, and can only be identified by its close resemblance to the holotype. A specimen 19 mm. in diameter and 14 mm. high is quite pentagonal with the ambulacra forming the angles; the apical disk is in very good condition and the madreporite is conspicuous with its poriferous portion much elevated; genital pores long and slit-like, reaching nearly to tip of distal angle of plates; there are three or four small tubercles along inner margin of each genital, and a single similar tubercle at center of each ocular. Two other specimens also show elongated genital pores but they are not so slit-like. Another pentagonal specimen is 17.5 x 11 mm. and shows, in spite of its poor condition, more secondary tubercles, especially orally, than any other. The largest specimen is badly distorted but was about 31 x 23 mm.; there are 16 coronal plates, about 25 ambulacral plates; the genital pores are large and oval. The smallest specimen is 10 x 8 mm. and has about 10

coronal plates, and 15 or more ambulacral plates in each column; it is essentially like the holotype; the genital pores are oval and not elongated or at all slit-like. It is probable that the specimens with elongated pores were males, while those with oval or circular pores were females.

At first these puzzling Echini were considered *Hebertia simplex* Hawkins but the differences in the apical system prevent regarding them as even congeneric with Hawkins's species. Like *perplexus*, *regularis* occurs at both ends of Jamaica. Some of the paratypes are from a hillside on the east bank of the Yallahs River, north of the upper bridge, in St. Thomas Parish. Others are from near Springfield, St. James, while specimens were seen in the Guys Hill region, St. Catherine.

PEDINIDAE.

Pedina sp.?

A specimen about 48 mm. in diameter and nearly 30 mm. high has perforate tubercles and broad, more or less triserial, poriferous areas. The ambulacra are nearly 15 mm. across at the ambitus, and the interporiferous area has two columns of rather small primary tubercles. There were 6 and perhaps 8 columns of similar but smaller tubercles in the interambulacra but there is some indication that they did not all extend far above the ambitus. On the whole it is not unreasonable to consider this specimen a Pedina, although the condition does not permit a specific description, and its generic status is by no means certain.

The specimen was found in the Yallahs River valley and is evidently from the hard gray rocks of that region.

SALENIIDAE.

Heterosalenia occidentalis Hawkins.

1923. Geol. mag., **60**, p. 206, pl. 9, fig. 4–6.

This fine large species, from the Rudist limestone, in the railway cut between Cambridge and Catadupa, St. James Parish, is not represented in the Arnold collection.

PHYMOSOMATIDAE.

Leiosoma chondra [1] H. L. Clark, sp. nov.

Plate 2, fig. 4–6.

Holotype.— Coll. B. W. A. 11. M. C. Z. 3,265. Seven Rivers region, St. James Parish. Among disintegrated rock-fragments.

[1] *χονδρός* = *coarse-grained*, in reference to the tuberculation of the test.

Test about 32 mm. long in one axis by 27 mm. wide in the one at right angles to it; owing to the absence of the apical disk and the crushed condition of the specimen, it is impossible to determine through which areas these axes run or whether the present oval form is normal; the probability is that the axes were equal in life and the ambitus rounded pentagonal; the present height of the specimen is 11 mm. and it is doubtful if it were much more in life.

Interambulacra nearly 10 mm. wide; coronal plates about 16 in a column, low and wide; each plate carries a rather conspicuous imperforate and non-crenulate primary tubercle which is a little nearer to the adradial suture than to the midline; a second smaller primary occurs on the inner end of the plates in the midzone and a third somewhat smaller tubercle is found at the lower outer corner, so that there are six columns of tubercles at the ambitus in each interambulacrum; below the ambitus, there are usually 2 more tubercles, 1 above the other on the outer (adradial) end of each plate; secondaries and miliaries, few and scattered.

Ambulacra about 9 mm. wide with about 18 plates in each column; these plates obviously contain at least 5 elements but it is impossible to make out any sutures; ambulacral pores large, nearly or quite circular, placed close together in each pair; from apex to ambitus, except close to apex the pores are arranged in a distinct, crowded but fairly regular double series; below ambitus, they are in a single very crowded series which widens a little near the peristome; each ambulacral plate carries a single conspicuous, imperforate, non-crenulate primary tubercle, and there is usually, in the midzone at least, a secondary tubercle at the lower inner corner of each plate, and another at the lower outer corner; there are a few other scattered secondary and miliary tubercles.

Apical disk wanting. Peristome distorted and largely concealed in matrix, but about 11 mm. across with well-marked, broad, but not very deep, gill-cuts.

There seems little reason to doubt that this is a typical Leiosoma, although the tuberculation is different in detail from that of any other known species. Apparently the genus has not hitherto been found in the western hemisphere.

Phymosoma peloria [1] H. L. Clark, sp. nov.

Plate 2, fig. 1–3.

Holotype.— Coll. B. W. A. 12. M. C. Z. 3,266. Spring Mount area, St. James Parish.

Test 75 mm. in diameter through an axis which may be III–5, and 72 mm. at right angles thereto. (Whether this form is the result of pressure cannot be posi-

[1] πελώριος = *huge*, in reference to its being much larger than other Phymosomas.

tively determined but it probably is, for many specimens are perfectly rounded pentagonal, although a number have a very evident long axis). Height of test, 25 mm.; ambitus rounded decagonal, the interambulacral margins slightly concave.

Interambulacra about 28 mm. wide at ambitus, 7 mm. at peristome and 6 mm. at apical end; coronal plates 18; at ambitus each plate is about 5 mm. high and 14 mm. wide, and carries a large, nearly central primary tubercle, which is markedly crenulate but imperforate; towards inner end of plate, near upper margin, is a much smaller tubercle, and at outer end two others, lower near corner of plate, upper nearer center; there are three secondary tubercles close to outer margin of plate, of which uppermost is much largest, lowest smallest; there are about ten small secondaries scattered on inner half of plate and about as many, together with some miliaries on outer half; below ambitus, principal series of primaries continues to peristome but inner one does not go quite so far and outer ones also disappear, but secondaries and miliaries are in evidence clear to peristome; above ambitus, principal primary series extends to apical disk, and inner one of the two outer series goes almost as far, but outermost and innermost series diminish rapidly and soon disappear; center of interambulacral area, a space 25 mm. long, from margin of apical disk, and about 4 mm. wide, is quite bare, smooth and markedly depressed.

Ambulacra about 18 mm. wide at ambitus, 7 mm. at peristome and only 2–3 mm. at apical end; ambulacral plates about 22 but their composition cannot be satisfactorily determined; from third plate to ambitus pore-pairs in a crowded double series, those of inner series alternating with those of outer; pores large, a trifle wider than high, with distance between two of a pair less than diameter of pore; pore-pairs somewhat further apart; below ambitus pores rapidly assume a uniserial arrangement and at peristome, poriferous areas are very narrow; they are nearly straight throughout, with pore-pairs in slightly indicated arcs of 5, 4 or on the oldest plates, 3. Each ambulacral plate carries a large, crenulate, imperforate primary tubercle, a large secondary tubercle at each lower corner, several small secondaries, and a number of miliaries; there are thus, at ambitus, three columns of tubercles in each half ambulacrum, but the middle one is much the largest, and above the ambitus the two lateral columns rapidly disappear.

Apical system practically wanting, but it was about 12 mm. across and very markedly sunken; genital plates extended deeply into interambulacra, a little more deeply into one (presumably 5) than into the others.

Peristome very deeply sunken, its margin 6–7 mm. below oral surface, about 22 mm. across; gill-cuts conspicuous, broad and 3–4 mm. deep.

There are 60 specimens of this fine species, the smallest 27.5 mm. long, 26.5 mm. wide and 11 mm. high; the largest is about 100 mm. in diameter and 32 mm. high, but it is considerably crushed. The most perfectly preserved specimen is 83 mm. x 38, with an almost circular ambitus. Not a single specimen shows the apical disk and only in the holotype is the peristome visible.

This species is found mostly in the Spring Mount area, beginning at Spring Mount and becoming more abundant as you approach Point, immediately beyond which it apparently ceases to occur. A young man near Cambridge, in response to questions, described oval stones with small blunt points and flat on one side, which he and others often found in the swimming pools of the Great River and used to rub themselves with, and these "rubbing-stones" proved to be Phymosomas!

There seems no good reason why this species should not be placed in Phymosoma, in spite of its large size. It is true that Duncan (1889, Journ. Linn. soc., Zool., 23, p. 86) in his diagnosis of the genus (under the preoccupied name, Cyphosoma) says the pores are "more crowded still at the peristome"; nevertheless he and Sladen described an echinoid (*C. abnormalis*) from the Sind, which has the pores arranged orally almost exactly as in the present species from Jamaica. The West Indian form is much the largest Phymosoma yet known and differs in form of test and in tuberculation from the species hitherto described. The superficial resemblance to a small Astropyga is striking.

Although Clark and Twitchell (1915, Monog. 54, U. S. G. S., p. 7) say that they have followed very closely in their generic usage Duncan's Revision, yet they have placed (*op. cit.*, p. 59) in Cyphosoma a species (*Pseudodiadema hilli* W. B. Clark) with the tubercles "deeply perforated," and Duncan distinctly says that the tubercles in Cyphosoma are "imperforate." As the imperforate condition of the tubercles is a deep-seated feature characteristic of the suborders Stirodonta and Camarodonta, it seems evident that *Pseudodiadema hilli* should be referred to some family of the Aulodonta.

STOMOPNEUSTIDAE.

Triadechinus [1] H. L. Clark, gen. nov.

Type.— *Triadechinus multiporus*, sp. nov.

Test large with high coronal plates, each with a single conspicuous imperforate primary tubercle; ambulacra broad, more than half the interambulacra; poriferous zones broad, made up, throughout practically the entire length, of three

[1] τριάς = *three* + ἐχῖνος = *sea urchin*, in reference to the notably triploporous ambulacra.

regular but crowded, vertical series of pore-pairs; interporiferous area, at ambitus, equal to or a little exceeding the combined widths of the poriferous zones. In midzone there is a single, irregular, vertical series of large primary tubercles, similar to those on the coronal plates; these tubercles do not form a zigzag, alternating series as would be expected, but 2–4 tubercles follow each other on the same side of the interporiferous area, before one occurs on the other side. Apical disk very small.

This genus is an extraordinary one, suggestive of Stomopneustes and of Codechinus, but differing from both in the tuberculation, particularly of the ambulacra. As no sutures between the plates can be made out, it is impossible to ascertain just what the relation is between primary tubercles, ambulacral plates, and pore-pairs. Apparently the large tubercles of the interporiferous areas, like those of Stomopneustes, cover several ambulacral plates, perhaps as many as ten; their present arrangement indicates that originally (*i.e.* in the young) there was a single primary tubercle on each ambulacral plate but that gradually a few tubercles grew to a disproportionate size, while many others were resorbed; these large tubercles have not developed symmetrically, however, alternating on the two sides of the area as they do in Stomopneustes, but occur 2, 3, or 4 in a vertical series on one side of the area, but so near its middle that at first sight there seems to be a median, unpaired series of disproportionately large tubercles in each ambulacrum.

Triadechinus multiporus [1] H. L. Clark, sp. nov.

Plate 1, fig. 10, 11.

Holotype.— Coll. B. W. A. 14. M. C. Z. 3,267. Mt. Sinai, Yallahs River, St. Thomas Parish.

Test about 70 mm. in horizontal diameter and about 43 mm. high, well arched dorsally so as to be nearly hemispherical, very much as in normal Stomopneustes. Peristome wholly concealed in matrix. Apical disk about 10 mm. in diameter but its component plates are all wanting.

Interambulacra about 30 mm. wide at ambitus; coronal plates probably 12 or more, the adapical ones very high, uppermost 2 or 3 higher than wide; in lower midzone and actinally they are much wider than high; each plate carries a large, central primary tubercle, imperforate and non-crenulate; areoles relatively small, little larger than primary boss of tubercle; on a plate 15 mm. wide, areole is 6 mm. across; scrobicular circle made up of two or three series of miliary tubercles; on the rest of the plate are scattered about half a dozen unequal secondaries and a

[1] multiporus = *having many pores*, in reference to the very large number of ambulacral pores.

dozen or more miliaries; median line of interambulaera marked by a very conspicuous, sinuous, depressed groove which extends from apical system to below ambitus, but is most marked adapically; this line is too narrow and shallow to call a furrow, but is a notable feature of each interambulaerum.

Ambulaera about 16 mm. across at ambitus, each poriferous area almost 4 mm. wide and interporiferous area a little more than 8; each poriferous area is made up of three nearly vertical series of small, closely crowded pore-pairs; on the oral surface, at one place, where the surface of the test is not worn, the peripodia are distinct and there is a miliary tubercle at or near the inner end of each one; there is a similar tubercle at the outer end of each of the outermost pore-pairs, so that in each poriferous area there are (at least, orally) four vertical series of miliary tubercles. The condition of the specimen does not permit one to determine how far adapically these series extend. Number of pore-pairs enormous, more than 300 in each poriferous area, or over 3,000 for the whole urchin; a Stomopneustes of about the same size has about 2,100, of which a third are in the flat petaloid areas near the peristome; if similar petaloid areas exist in Triadechinus, as seems highly probable from the appearance of the lowest visible portion of one of the ambulaera, the actual number of pedicels would probably exceed 4,000.

Interporiferous area remarkable for its tuberculation; as already stated in the diagnosis of the genus, each large imperforate primary tubercle apparently covers many ambulacral plates; these tubercles appear to form a single irregular vertical series; above the midzone, where the primaries are small, they show a tendency to alternate on the two sides of the area more regularly than they do on the older part of the test, but practically throughout the entire ambulacrum, the primaries are disproportionately large as compared with the width of the poriferous area and dwarf or cover up the inner ends of the ambulacral plates of the adjoining column, so that it is very difficult if not impossible to distinguish the usual two columns of ambulacral plates in the interporiferous area. Unfortunately the condition of the specimen prevents delimiting either the ambulacral plates or their component parts.

There is only a single specimen of this extraordinary sea-urchin, whose exact systematic position cannot be determined in the absence of the apical disk and peristome. Because of the character of the ambulaera, it may for the present, at least, be placed in the Stomopneustidae.

In the debris associated with the type there were fragments of spines, but unfortunately they could not be detached from the extremely hard rock.

ECHINIDAE.

Scoliechinus [1] H. L. Clark, gen. nov.

Type.— *Scoliechinus axiologus*, sp. nov.

Test small or of moderate size, somewhat hemispherical, not low, but flattened orally; ambulacra about two thirds as wide as interambulacra; poriferous zones wide, each one exceeding half the interporiferous area; pore-pairs in arcs of three but these arcs are most evident when test is inverted; in normal position, the inner, upper pore-pair is so considerably separated from the other two by a pair of large secondary tubercles it does not seem to belong with them but rather with the two pairs of the next plate above, especially since the pore-pair of the next element below lies far outside the natural curve of the arc; ambulacral plates echinoid, consisting of three elements of which the adoral, a well-marked primary, is largest; middle element also usually a primary, though apparently it does not always reach the midline; aboral element clearly a demiplate, not reaching outer margin of ambulacrum; median element projects conspicuously into interambulacral area, beyond basal element. Primary tubercles numerous, largest orally, imperforate and non-crenulate. Apical system wanting. Peristome large with deep, narrow gill-cuts.

This genus is at first sight near Lytechinus but the difference in the ambulacral plates is so marked that they must be regarded as distinct genera, perhaps not even closely related. Compared with *L. semituberculatus*, the resemblance in peristome, gill-cuts and tuberculation is striking, but in Lytechinus the middle element of the ambulacral plates is a small demiplate whose pore-pair is in perfect alignment with the curve of the arc formed by it and the other two elements. The arrangement of the pore-pairs is thus strikingly unlike in the two genera.

Scoliechinus axiologus [2] H. L. Clark, sp. nov.

Plate 2, fig. 7, 8.

Holotype.— Coll. B. W. A. 15. M. C. Z. 3,268. Leyden region, St. James Parish.

Test somewhat hemispherical, quite flat orally, 25 mm. in diameter and 14 mm. high.

Interambulacral areas rather more than 9 mm. wide at ambitus, narrowing gradually to apex and abruptly to peristome; coronal plates low and wide, 22 or

[1] σκολιός = *crooked* + ἐχῖνος = *sea-urchin*, in reference to the unusual arrangement of the pore-pairs.
[2] ἀξιόλογος = *remarkable*, in referenee to the peculiar poriferous zones.

23 in each column; at ambitus each plate carries 4 primary tubercles, next to outermost near lower margin of plate, outermost and two inner ones nearer to upper margin; below ambitus tubercles larger and more crowded and innermost series soon ceases; outermost series ends just above gill-cut; remaining two continue nearly or quite to peristome; above ambitus outermost series diminishes rapidly in size and soon disappears; next series to it continues to apex; next extends halfway or more towards apex, and innermost extends only one third of way; there is thus a narrow, but quite distinct, bare area in each interambulacrum adapically; at ambitus there may be as many as a dozen secondary and miliary tubercles on each plate but adorally these are quickly crowded out by primaries; adapically the number diminishes more slowly and some persist clear to the genital plate.

Ambulacral areas a little more than 6 mm. wide at ambitus, diminishing rather gradually both above and below; ambulacral plates, poriferous zones, and arrangement of pore-pairs as described above in diagnosis of genus; ambulacral plates about 27 in each column; interporiferous area with 4 columns of primary tubercles at ambitus, between which are 3 less complete series of very small secondaries; below ambitus secondaries disappear and the two median columns of primaries merge into one which continues almost to peristome; above ambitus the 2 median columns become smaller and more scattered and finally disappear, only the outer columns reaching the ocular plate; there is thus a narrow, bare median area as in the interambulacra, only it is much less evident.

Apical system wanting. Peristome large, over 11 mm. across, with deep, narrow gill-cuts placed on the ambulacral boundaries.

This is a most interesting species, suggestive of an ancestral form for Lytechinus, but the absence of the apical disk prevents as close a study of this relationship as is desirable.

The unique holotype was probably from the dark formations through which the up-hill road is cut, immediately south of the forks.

HOLECTYPIDAE.

Metholectypus trechmanni Hawkins.

1923. Geol. mag., **60**, p. 201; pl. 9, fig. 1–3.

This species was described from a single specimen taken from the Barrettia limestone at Haughton Hall, near Green Island, Hanover Parish. It is not represented in the Arnold collection.

CONULIDAE.

Amblypygus americanus Desor.

1858. Syn. Éch. foss., p. 256.

Plate 3, fig. 1–3.

This fine species, hitherto known from only three specimens, occurs commonly in the extremely hard rock of the Mt. Sinai region of the Yallahs River district, St. Thomas Parish. The present series of 28 specimens is notable for the large size of many of the specimens; the largest is 126 mm. in longest diameter and rises 50 mm. above a level surface, but the test is actually only 40 mm. in vertical diameter, the additional 10 mm. being due to the marked concavity of the oral side. A smaller specimen, which shows the dorsal side very well, is 82 x 37 mm.; the oral side is quite flat, not arched as in the larger specimen. In both the adoral depression is very deep and the periproct large. In the larger specimen the posterior end of the periproct is 19 mm. from the posterior end of the test; in the smaller specimen that measurement is but 11 mm. None of the specimens are perfectly circular at the ambitus but in each a long diameter can be distinguished. In the two specimens mentioned above the difference between the long and short diameters is inconsiderable but in many of the specimens it is marked. Thus the smallest specimen is 47 mm. long but only 40 mm. wide; its vertical diameter is 17 mm. A very large specimen 124 mm. long is only 116 mm. wide, with the vertical diameter 45 mm.

CLYPEASTRIDAE.

Clypeaster sp.?

The absence of fossil Clypeasters in Jamaica is very remarkable. Jackson (1922) lists a single specimen of *C. cotteaui* Egozcue, purchased of Ward, and said to be from Jamaica. Hawkins, in his two papers (1923, 1924), gives no Clypeasters and comments on their absence. In his manuscript list there are three identified species and three other forms which are doubtful, presumably because of unsatisfactory material. These three are listed as "*oxybaphon?*", "*platygaster??*" and "*cf. caudatus.*" His identified species are noted below.

There are but three specimens of Clypeaster in the Arnold collection and none of them were actually collected in the field, and the localities whence they came are uncertain. Moreover their condition is very poor and their identification is uncertain. Evidently the Jamaican fossil Clypeasters are most unsatisfactorily known.

Clypeaster antillarum Cotteau.

1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 15, pl. 2, fig. 1–3.

Plate 3, fig. 4. Plate 4, fig. 1, 2.

There are two small Clypeasters considered, for the present at least, as the young of this large West Indian species. One of the specimens is so badly weathered that its margins are more or less destroyed and it is shorter and narrower than the better one, though its petaloid area is appreciably longer and wider. It is flatter dorsally too and its upper surface never sloped from margin to apex as much, but in all other respects it is similar, and there is no reasonable doubt that the two specimens represent the same species. The better one (Plate 3, fig. 4) shows why it seems best to consider these specimens the young of *antillarum;* most important are the form and position of the periproct, the sunken mouth and the well-marked oral ambulacral grooves. The form of the petals and of the interporiferous areas are not exactly like those shown in the figures of either Cotteau (1875, *loc. cit.*, 1897, Boll. Com. Mapa geol. España, **22**, pl. 7, fig. 1–3) or Jackson (1922, Carnegie inst. Wash., Publ. 306, pl. 5, fig. 1, 2), but they are sufficiently near Jackson's to warrant the belief that the differences are only a matter of size or age or both. Until more material is available showing growth changes and the range of individual diversity, it seems better not to add another species to the already overtaxed genus Clypeaster, since these specimens can reasonably be referred to a species already named.

The specimens were presented by the Curator of the Jamaica Institute Museum at Kingston. They have no definite locality labels but are probably from a river near Port Maria.

Clypeaster concavus Cotteau.

1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 16, pl. 2, fig. 4–8.

Hawkins includes this species in his manuscript list and says it is from the "Oligocene (white limestone)." It is not represented in the present collection.

Clypeaster cotteaui Egozone.

1897. Boll. Com. mapa geol. España, **22**, p. 40, pl. 10, fig. 1–4.

This species is recorded from Jamaica, but with no more definite locality, by Jackson (1922, Carnegie inst. Wash., Publ. 306, p. 42). A Clypeaster in the present collection worn smooth and polished, partly by water and partly no doubt by being carried as a "lucky stone," seems nearer to *cotteaui* than to any other,

though the petals are not so wide at the tip as they should be. It was purchased in 1912 from a member of the Jamaica constabulary, then acting as a policeman in the Bahama Islands, who stated that he found this specimen in a river near Port Maria, Jamaica. The policeman had carried this specimen for many years as a good luck trophy, supposing that it was one of the West Indian "thunder bolts." The name "thunder bolt" (world wide among barbaric peoples) was naturally applied by the African slaves to the prehistoric celts which occurred throughout the West Indies, the theory being that the thunder bolts dropped from the heavens during thunder storms, penetrating the rock or earth to considerable distance, where they remained for seven years before rising to the surface. In going down into the earth, the bolt received its blade-shaped form and in coming again to the surface it received its pointed form at the other end from the blade, thus accounting for the beautiful stone celts (including diorite, nephrite and jadite) which were long ago made by the Lucayans and Aroaks and have since been the "voodoo stones" of Santo Domingo and elsewhere. This specimen conforms slightly with the blade of a thunder bolt. The point, however, is lacking, but the constable explained that the individual petal (III) at one end was the point, and the two petals (I and V) at the opposite end were the blade of his beloved thunder bolt, which was "positively genuine!"

Clypeaster lanceolatus Cotteau.

1897. Boll. Com. mapa geol. España, **22**, p. 39, pl. 9, fig. 1–3.

This species occurs in Hawkins's manuscript list as from the "Oligocene (white limestone)." It is not represented in the present collection.

FIBULARIIDAE.

Fibularia jacksoni Hawkins, sp. nov.

1927. Mem. M. C. Z., **50**, p. 76, pl. 22, fig. 1–3.

Plate 4, fig. 3–5.

There are half a dozen specimens of this species, taken from the east side of the west branch of the Rio Nuevo, about halfway between Guys Hill and where the west branch joins the river. This region seems very promising for fossils but is rather inaccessible and little collecting has been done there. These Fibularias are somewhat larger than Hawkins's specimens and for the most part represent the flatter form shown by his smaller specimens, which he thought an indication of immaturity. It is more probably merely a matter of individual diversity, but

apparently the high form is the rarer extreme. Measurements in millimeters are:— 8.5 x 7 x 6, 9 x 8 x 5.75, 9.5 x 8.5 x 5.75, 10 x 7.5 x 7, 10 x 8 x 7, 10 x 8.5 x 6; the height is thus .60–.70 of the length.

Sismondia crustula Hawkins, sp. nov.

1927. Mem. M. C. Z., **50**, p. 78, pl. 22, fig. 4, 5.

This interesting species, although found several times by Dr. Treehmann, is not represented in the present collection.

SCUTELLIDAE.

Mellita quinquesperforata (Leske).

Echinodiscus quinquesperforatus Leske, 1778. Add. ad Klein, p. 133.
Mellita quinquesperforata Meissner, 1904. Bronn's thier-reichs, **2**, abt. 3, buch 4, p. 1384.
Mellita pentapora (Gmelin) Clark & Twitchell, 1915. Monog. 54, U. S. G. S., pl. 106.

Hawkins, in his manuscript list, gives this well-known species as from the Pleistocene deposits of Jamaica. It is not represented in the Arnold collection. As a Recent form it is known from Jamaica but seems to be rare.

NUCLEOLITIDAE.

Botriopygus rudistarum Hawkins.

1923. Geol. mag., **60**, p. 213; pl. 9, fig. 7–9.

This species is based on a single specimen found in the Great River valley below Catadupa, St. James Parish. It is not represented in the present collection.

Oligopygus hypselus [1] H. L. Clark, sp. nov.

Plate 4, fig. 6–8.

Holotype.— Coll. B. W. A. 45. M. C. Z. 3,269. Spring Mount, St. James Parish.

Test 33.5 mm. long, 27.5 mm. wide and 21 mm. high; the width is thus about .80, the height about .66, of the length; the posterior end of the test is somewhat thicker than the anterior but not markedly so; test well rounded at both ends and also with a thick well-rounded ambitus. Petaloid area 26 mm. long by 20 wide; petals I and V are 11 mm. long by 4.75 wide, II and IV are 10 by 5 mm. and III is 14.5 by 5 mm.; all the petals are open at the tips. Peristomal furrow shallow but well marked, 11 mm. wide and 4.5 mm. long; it thus occupies about .40 of the

[1] ὑψηλός = *high*, in reference to the form of the test.

test width; peristome itself not visible. Periproct small, nearly circular, about 2.5 mm. in diameter; its center is 7 mm. from posterior margin of test, 11 mm. back of anterior margin of peristomal furrow, which is itself about 15 mm. from anterior margin of test.

There are seventeen specimens available of this well-marked species, which is easily recognized by its high, narrow form. There is little diversity shown except in the amount of weathering and the degree to which the peristomal furrow is revealed. The tuberculation is coarse, conspicuous and quite uniform, except as affected by weathering. This species was found in a dark colored formation north and west of Spring Mount, St. James Parish.

OLIGOPYGUS JAMAICENSIS [1] H. L. Clark, sp. nov.

Plate 4, fig. 9–11.

HOLOTYPE.— Coll. B. W. A. 47. M. C. Z. 3,270. Spring Mount region, St. James Parish.

Test 39 mm. long, 36 mm. wide and 18.5 mm. high anteriorly but only 16 mm. posteriorly; the width is thus over .90, and the height over .47, of the length; the anterior end of the test is markedly thicker than the posterior; test quite flat dorsally and well rounded at both ends. Petaloid area 30 x 28 mm.; petals I and V are 15 mm. long by 5 wide; petals II and IV 13 x 4.5 mm.; III 17 x 5 mm.; all petals widest at or near to tip, the two poriferous areas together equalling or exceeding the interporiferous. Apical system moderate, with 4 genital pores; not peculiar in any way.

Peristomal furrow deep and conspicuous, 20 mm. by 6 mm. and about 4 mm. deep, perhaps more; peristome completely concealed. Periproct circular, 3.5 mm. in diameter, its center 10 mm. from posterior margin of test, 12 mm. from anterior margin of peristomal furrow which is itself 17 mm. from anterior end of test.

There are 245 specimens of this Oligopygus from the region north and west of Spring Mount, St. James Parish, where it is common; it was not met with elsewhere. The examination of this large series establishes the validity of the peristomal furrow as a generic character. It is so constant and so conspicuous a feature, even affecting the form of the test, that there need be no hesitation in making it the distinctive character of the genus. There are now 5 species which agree in this feature, while showing certain specific characters which distinguish them from each other; in order to make their interrelationships clear the following key is offered.

[1] jamaicensis = *pertaining to Jamaica.*

Key.

Height of test about one half its length.
Height rather less than half length.
Periproct midway between peristome and posterior margin; upper surface flattened or moderately convex.
Width of test about .85 of length; peristomal furrow moderate, extending across one third to one half of test width ..... *wetherbyi.*
Width of test about .90 of length; peristomal furrow very large, extending across one half to two thirds of test width ..... *jamaicensis.*
Periproct inframarginal; upper surface convex ..... *haldermani.*
Height rather more than half length; upper surface convex; periproct small, midway between peristome and posterior margin ..... *floridanus.*
Height of test about two thirds of its length; peristomal furrow relatively small ..... *hypselus*

There is no doubt that the species *wetherbyi*, *jamaicensis*, and *floridanus* are very closely related but so far as can be judged without actual comparison of specimens it is better to treat them as distinct rather than unite them under a single name. Apparently *jamaicensis* is the widest and flattest form with the most extreme development of the peristomal furrow, but half-grown specimens are not always very different from *wetherbyi*. The series ranges in size from 13 x 10.5 x 7 mm. to 42 x 37 x 19 mm. There is great diversity in form, the width ranging from .84 to .92 of the length and the height from .45 to .53, but the narrower and higher specimens are relatively rare and usually small. The test is low and generally flattened; the front end while usually thickest is not always so. The peristomal furrow is always large and conspicuous and usually more or less filled with matrix; in one specimen this has weathered out enough to show that the peristome occupies a nearly vertical position on the anterior wall of the furrow.

Like *hypselus*, *jamaicensis* occurs in a dark colored rock formation in a restricted area north and west of Spring Mount, St. James Parish. A few were found, however, on the east side of the Yallahs River, at the other end of the island. Possibly Oligopygus comes from a formation which, if extensive, has been badly disturbed by pressure or subterranean causes, placing it at a much higher elevation at the east end of the island than at the west end. They seem to occur exclusively in the dark colored formation.

Pauropygus [1] H. L. Clark, gen. nov.

Type.— *Echinolampas ovumserpentis* Guppy.

Ambulacra petaloid, but the petal is made up of primary plates, while the non-petaloid portion is made up of primaries and demiplates; phyllodes absent, the adoral end of each ambulacrum consisting of simple primaries only. Peristome

[1] παῦρος = *few*, equivalent to ὀλίγος; the most closely related genus being Oligopygus.

circular or pentagonal, central or subcentral, often sunken in the thick test but with no peristomal furrow like that of Oligopygus. Periproct circular, inframarginal or more adoral, but never close to peristome.

In the structure of the ambulacra, Pauropygus and Oligopygus are alike and the only important difference is in the matter of the peristomal furrow. Hawkins is not convinced that this is a valid distinction but after an examination of hundreds of Jamaican specimens there can be no question as to its constancy and value. Under the circumstances it is necessary to make *ovumserpentis* the type of a new genus; there is general agreement now that it is not only no Echinolampas but does not even belong in the Cassidulidae.

The number of specimens of Pauropygus brought back from Jamaica proves a source of great embarrassment for they show such extraordinary diversity in form, in the size and shape of the petals, and in the position of the periproct that it is simply impossible to treat them as a single species. On the other hand the attempt to separate them into distinct, homogeneous, well-defined groups, which may be treated as species, becomes equally impossible. After long and careful comparison and study the great majority of the specimens are considered *ovumserpentis*, but more than three hundred specimens are so constantly different that they cannot be so called. These three hundred specimens fall rather naturally into eleven groups, several of which are represented by only a single specimen. These groups are as a rule easy to distinguish from each other, but most of them undoubtedly intergrade with *ovumserpentis* to a greater or less degree. The determination of these groups as natural species, or varieties, or merely clusters of individual variants is not easy and the simplest method, and the one least productive of confusion, is to consider them as incipient species, describing and figuring a typical example of each. In view of the large amount of material and its extraordinary diversity, this cannot be classed as a case of needless "splitting."

The following key includes all the Echini belonging in Pauropygus, not only the species described as new but Guppy's *ovumserpentis* from Trinidad and elsewhere, and Sanchez Roig's *alvarezi* from Cuba.

Key.

Test high, height .60–.80 of length; generally not flattened dorsally; apical system at highest point; periproct near posterior margin of oral surface.

Ambitus rounded pentagonal or nearly circular; height of test .75–.80 of length; apical system central; petaloid area small, about half of dorsal surface.

Posterior end rounded; posterior petals very short, their width more than half length; peristomal region deeply sunken ..... *alvarezi.*

Posterior end more or less evidently truncate; posterior petals about one third as wide as long or a little more; peristomal region not sunken ..... *altus.*

Ambitus elliptical or oval, width rarely more than .85 of length; height .60–.80 of length.
Dorsal surface rather flat; apical system central; petaloid area moderate; lower surface not flattened but rounded with very little depression at peristome.....*elevatus.*
Dorsal surface not flattened; apical system more or less excentric posteriorly.
Oral surface, as well as dorsal, rounded; petaloid area moderately large, about two thirds of dorsal surface.....*cylindricus.*
Oral surface flattened; dorsal surface with apical system markedly elevated; petaloid area small, little more than one third of dorsal surface.....*pyramidoides.*
Test seldom over .55 of length in height, flattened or arched dorsally, and occasionally with apical system elevated.
Test very wide, its width .87–.95 of length, not well arched dorsally but more or less flat, the height usually much less than half length.
Periproct nearer to mouth than to posterior end of test; petaloid area large with broad petals. *latus.*
Periproct near posterior end of test, often almost submarginal.
Petaloid area small, about half dorsal surface; test very low and flattened.....*rotundus.*
Petaloid area large, about three fourths of dorsal surface; petal III very long; test higher, not so flattened, uneven (when not much weathered).....*rugosus.*
Test not so wide usually, not much over .80 of length; when wide, dorsal surface well arched and height is half of length or more.
Each interambulacral plate of dorsal surface (except small ones near apex) markedly convex; interporiferous areas of petals elevated into rounded ridges; oral surface flat; periproct small, halfway between mouth and margin; width of test .80 of length; height .53.....*convexus.*
Not as above.
Petaloid area small, about .35–.40 of dorsal surface; petals short and wide; periproct near posterior margin.....*parvipetalus.*
Petaloid area more than half dorsal surface.
Test narrow and low, width .70–.77 of length; height less than .40 of length; petals long and narrow, with interporiferous areas narrow, sometimes narrower than one poriferous area; periproct near posterior margin.....*stenopetalus.*
Not as above.
Test truncate anteriorly, somewhat round-pointed behind; height more than half length; petals wide but interporiferous areas narrow; dorsal surface flat; oral surface not at all concave.....*platypetalus.*
Test rounded or round-pointed anteriorly, its width .75–.92, its height .43–.62 of length; dorsal surface evenly arched or more or less flattened; petaloid area large, two thirds or more of dorsal surface; ventral surface flattened or concave; periproct halfway between mouth and margin, or nearer margin, often quite near; petals very diverse in size, form and proportions.....*orumserpentis.*

In estimating the petaloid area, the most convenient way is to multiply its greatest length by its greatest width, and divide the product by the product of multiplying the length of the test by its greatest breadth. The greatest length of the petaloid area is from the tip of petal III to a straight line drawn across interambulacrum 5 from the tip of petal I to the tip of petal V; the greatest breadth is from the tip of petal II to the tip of petal IV.

For convenience of reference, the species of Pauropygus are arranged alphabetically and not as they occur in the key. *Pauropygus alvarezi* is not yet known from Jamaica.

PAUROPYGUS ALTUS [1] H. L. Clark, sp. nov.

Plate 4, fig. 15–17.

HOLOTYPE.— Coll. B. W. A. 50. M. C. Z. 3,271. Near Spring Mount, St. James Parish.

Test 31 mm. in length, 29 mm. in width and 25.5 mm. in height; the width is thus over .93 of length and the height is over .82. Ambitus rounded pentagonal but nearly circular. Petaloid area 27 x 19 mm., or .57 of dorsal surface; petals I and V are 10 mm. long by 4 mm. wide; II and IV 9.5 x 4.5 mm.; III 10 x 4; all petals are broadest near tip and are widely open; poriferous areas show some diversity in relative width. Apical system central, with 4 large genital pores as usual.

Peristome nearly central; its center 16.5 mm. from anterior margin; pentagonal nearly 4 mm. across, with no depressed area around it. Periproct about 3 mm. in diameter; its center is 10 mm. from center of peristome and hence only 4.5 mm. from posterior margin.

There are 175 specimens, ranging from 9 x 8.5 x 8 mm. to 44 x 38 x 30, referred to this species. They show great diversity in their petals and some diversity in form; the largest specimen is considerably weathered and its identity is not beyond question; the small specimens approach young *ovumserpentis* and the line between the two species is not as sharply defined as one might wish. But adult specimens of *altus* are easily recognized. The resemblance to the Cuban species *alvarezi* is considerable but none of *altus* has the posterior end as rounded and in no case are the petals nearly so short and wide.

Most of the specimens of *altus* were collected near Spring Mount, St. James Parish, in or near rather soft and disintegrated strata. But the species also occurred on a hillside near Lucky Hill, St. Mary.

PAUROPYGUS CONVEXUS [2] H. L. Clark, sp. nov.

Plate 4, fig. 18–20.

HOLOTYPE.— Coll. B. W. A. 55. M. C. Z. 3,272. Near Lucky Hill, St. Mary Parish.

Test 26 mm. long, 21 mm. wide and 14 mm. high; the width is thus .80 of length and the height is .53. Surface of test uneven, as each interambulacral plate above ambitus (excepting only the small ones near apical system) is markedly

[1] altus = *high*, in reference to the form of the test.
[2] convexus = *arched*, in reference to the convexity of the coronal plates.

convex, and the interporiferous areas of the petals are elevated into low, rounded ridges. Apical system nearly central, its center 14 mm. from anterior end of test; genital pores very small and hard to distinguish; madreporic body conspicuous, 2.5 mm. long.

Petaloid area 20 x 17 mm. or .62 of dorsal surface; petals I and V are 8 mm. long by 4 mm. wide; II and IV 8 x 4.5 mm.; III 12 x 4.

Peristome central, small. Periproct small, about 1.5 mm. in diameter, apparently longer than wide, exactly halfway between mouth and margin. Oral surface quite flat, a little depressed around peristome.

There is only a single specimen of this well-marked form and no other specimen in all the long series of Pauropygus shows any near approach to it. It was found near Lucky Hill, St. Mary Parish.

Pauropygus cylindricus [1] H. L. Clark, sp. nov.

Plate 4, fig. 12–14.

Holotype.— Coll. B. W. A. 56. M. C. Z. 3,273. Hillsides between Seven Pines and Springfield, St. James Parish.

Test 30.5 mm. long, 25 mm. wide, and 24 mm. high; the width is thus about .82 of length and the height is practically the same. Test almost cylindrical in the vicinity of the apical system, which is barely excentric posteriorly, not flattened either above or below; apical system somewhat elevated; posterior end of test flattened or truncate. Petaloid area moderate, about 24 x 21 mm., or .66 of dorsal surface; petals I and V are 11 mm. long and 5.5 mm. wide; II and IV 10.5 x 5 mm.; III 12 x 5.5; poriferous areas in all petals notably broad.

Peristome small, central, slightly depressed. Periproct 3 mm. in diameter, its center only 4 mm. from posterior margin.

There are twenty specimens referred to this species, distinguished by the lack of any flattening dorsally and orally, the truncate posterior end, the posterior position of the apical system, which is often marked, and the almost submarginal periproct. The poriferous areas show much diversity in their width and the petals may be much narrower than in the holotype. While typical examples are easily recognized, this species grades into *altus* and *elevatus* on the one hand and into *ovumserpentis* on the other.

The specimens of *cylindricus* were found in eroded material on hillsides be-

[1] κυλινδρικός = *cylindrical*, in reference to the fact that midway between the two ends, the test tends to be cylindrical.

tween Seven Rivers and Springfield, St. James Parish. They are much alike in color, texture, and character of the matrix. They range in size from 13 x 11 x 9 mm. to 31 x 26.5 x 22.

PAUROPYGUS ELEVATUS [1] H. L. Clark, sp. nov.

Plate 5, fig. 1–3.

HOLOTYPE.— Coll. B. W. A. 58. M. C. Z. 3,274. West side of the Yallahs River, St. Thomas Parish.

Test 29 mm. long, 23 mm. wide and 20 mm. high; the width is thus a little less than .80 of length, and the height about two thirds of length. Test flattened above, rounded below, narrowed in front, somewhat truncate behind. Genital pores large. Petaloid area 22 x 17 mm. or .60 of dorsal surface; petals I and V 10.5 x 4.25 mm.; II and IV 9 x 4 mm.; III 11 x 4.25 mm.

Peristome central, little depressed. Periproct small, 2 mm. in diameter, its center 9 mm. from the posterior margin.

There are thirty-two specimens of *elevatus*, ranging from 14 x 12 x 10 mm., a typical specimen, to 33 x 28 x 24.5 mm., which is more like *cylindricus*, the species to which *elevatus* is most closely allied. Among these thirty-two specimens, some approach *ovumserpentis*, and the line separating them from that species is not as clearly defined as could be wished. While most of the specimens are from the west side of the Yallahs River, St. Thomas Parish, some are from the other end of the island in St. James Parish.

PAUROPYGUS LATUS [2] H. L. Clark, sp. nov.

Plate 5, fig. 4–6.

HOLOTYPE.— Coll. B. W. A. 60. M. C. Z. 3,275. Hills west of Spring Mount road, St. James Parish.

Test 33.5 mm. long, 30 mm. wide and 15 mm. high near anterior end; near posterior end the height is only 13.5 mm.; the width is thus about .90 of length and the height is only about .45. Test flattened dorsally and ventrally but with thick well-rounded ambitus. Genital pores small. Petaloid area large, 29 x 27 mm., or nearly .80 of dorsal surface. Petals broad; I and V 13.5 x 7 mm.; II and IV 13 x 6.5 mm.; III 13.5 x 6 mm.

Peristome central, rounded pentagonal, 4 mm. in diameter, the surrounding area scarcely depressed. Periproct small, only 2.5 mm. in diameter, circular; its

[1] elevatus = *raised*, in reference to the form of the test.
[2] latus = *broad*, in reference to the width of the test.

center is 9 mm. from posterior margin of test and only 6 from posterior margin of peristome.

There are only nine specimens of this, one of the best defined species in the genus. The smallest is 28 x 24.5 x 12 mm.; it is water-worn and smooth, typical except for petal III, which is aberrant; it is 10 mm. long, 5 mm. wide near tip, and has no pores whatever throughout the proximal 3.5 mm. The largest specimen is 41.5 x 37 x 23 mm. and is more arched than usual, the actual thickness of the test being only 20–21 mm. This species is well distributed in Jamaica, as it was taken in the hills west of the Spring Mount road, St. James, again very near where the Seven Rivers empties into Great River, St. James, and again in the region south of Lucky Hill, St. Mary.

Pauropygus ovumserpentis (Guppy).

Echinolampas ovumserpentis Guppy, 1866. Quart. journ. Geol. soc. London, **22**, p. 300, pl. 19, fig. 4–6.
Oligopygus ovumserpentis Stefanini, 1911. Riv. Ital. pal., **17**, fasc. 4, p. 88.

Plate 5, fig. 7–12.

Thanks to the kindness of Dr. Alexander Wetmore and Mr. Austin H. Clark, we have had the opportunity of re-examining Guppy's material of this species from Trinidad. There is no doubt that Guppy included in his *ovumserpentis* more than one species. The specimens, U. S. N. M. 115,389, are typical *ovumserpentis* and that figured by Guppy (Fig. 4*b*) is considered the holotype, although it is rather longer and narrower than most specimens; some one of these must be so regarded. Guppy's figure 4*a* does not correspond with any of the U. S. N. M. specimens, nor with any Pauropygus seen by us. If it is intended to represent the same specimen as 4*b*, it is badly drawn. Of the six specimens of Guppy's U. S. N. M. 115,409, only one is clearly *ovumserpentis;* of the others, the smallest is apparently a fibulariid, a second is a very flat Pauropygus, and the other three represent two species of Oligopygus, allied to, if not identical with, *hypselus* and *jamaicensis* of the present report. They are young and the preservation is not very good. The very flat Pauropygus owes its flatness, to some extent at least, to pressure and it may well be that its peculiarities are altogether artificial.

Among the Jamaican specimens of Pauropygus, none agree in all respects with the types of *ovumserpentis* from Trinidad, though a few small ones show no peculiarities of the least importance. But the differences shown are so inconstant and unreliable that it seems best to refer the bulk of our Jamaican specimens of Pauropygus to Guppy's species. While there is considerable diversity in the form of the test, the most surprising variety is shown in the petals, for while they are

always comparatively large, their relative width is variable and the width and form of the poriferous areas, and the degree of their divergence, are astonishingly diversified. Associated, of course, are the width and the form of the interporiferous areas. In one of Guppy's paratypes, petal I is 15 mm. long, 5 mm. wide at middle, 5.5 at tip; each poriferous area is only a little over 1 mm. wide and the width is quite uniform, only narrowing a little at each end; the interporiferous area is 2.5 mm. wide at middle and 3 mm. distally. No Jamaican specimen has petals just like that, as the poriferous areas are wider and tend to expand distally, and the interporiferous area is narrower. A typical Jamaican specimen has petal I 13 mm. long, 5 mm. wide at middle and also at tip, but the poriferous areas are each 1 mm. wide only near proximal end, and distally become 2 mm. wide, narrowing slightly at tip; the interporiferous area is 2 mm. wide distally but is not quite that at the middle. An extreme specimen has petal I 12 x 4.5 mm. (middle) and 6 mm. (tip); poriferous and interporiferous areas each about 2 mm. wide from middle to tip. Another specimen shows petal I 12 x 5.5 (middle) and 4 mm. (tip), with poriferous areas nearly 2 mm. wide at middle but only 1.5 or less, proximally and distally; interporiferous area about the same. All sorts of intergradations between the extremes occur, indicating that the form and proportions of the petals in *ovumserpentis* do not afford valid characters on which to base even varietal names.

Another feature in which this species shows great diversity is the position of the periproct. In Guppy's types the periproct is small and near the posterior margin of the ventral surface; in the largest specimen it is only 2.5 mm. across and is scarcely 3 mm. from margin; in a smaller specimen it is less than 2 mm. across and is only 1 mm. from margin. In Jamaican specimens there is more diversity; a typical specimen, 33 x 28 mm., has the periproct 3.5 mm. across and less than 3 mm. from margin and a slightly smaller specimen has a periproct 2.5 mm. across, only 2 mm. from margin, but a specimen 32 x 25 mm. has a periproct only a trifle over 2 mm. across, almost 5 mm. from margin, and a specimen 32 x 27 mm. has a periproct over 2 mm. across, some 6 mm. from margin and only a little over 6 mm. from posterior margin of peristome.

As regards size and form, the diversity is very great. Guppy's specimens are larger than most of the Jamaican, several exceeding 40 mm. in length. The vast majority of our Jamaican *ovumserpentis* are less than 30 mm. long but there are a few that exceed 40 mm. The largest is a badly-weathered specimen, 52 x 43.5 x 24 mm.; the condition is so poor that the identification cannot be regarded as certain. There are no specimens intermediate in size between these very large

ones and those 30–33 mm. long, and the inclination first was to consider them a separate species. But after examining Guppy's material it seemed best to regard them as exceptionally large *ovumserpentis*.

In form, Guppy's specimens have the width of the test .75–.92 of the length and the height is .43–.57; the upper surface is not flattened but is rather evenly arched with an evident apex. Jamaican specimens show about the same diversity in width, .77–.91 of length, but a much greater diversity in height is shown, .40–.65. The dorsal surface, although sometimes well arched and with a definite apex, is usually more or less flattened and may be quite flat.

There are three small specimens, about 20 mm. in diameter, notable for having only *four* petals, and seeming to be regularly tetramerous. They are all relatively high, and in one, which is somewhat deformed, the height is over .70 of length. It does not seem to be possible to determine beyond question which areas are missing.

Altogether there are 1,111 specimens referred to Guppy's species, all which are not definitely placed in some other species. Many are very small, ranging from 7 x 5.25 x 5.25 mm. to 10 x 7.5 x 7, and thence by a completely graded series up to the 30 mm. specimens. As previously stated, there is no question that very many of these specimens are not typical *ovumserpentis* and they often approach and obscure the lines supposed to delimit other species. This is obviously the most common fossil sea-urchin in Jamaica, occurring generally throughout the island, particularly in the Cambridge-Catadupa section and the hills between Spring Mount and Montpelier. They are often in disintegrated strata and frequently quite perfect. They will be among the first specimens secured by the collector, as they may be found in almost any soft, broken-down strata throughout formations where fossil Echini occur.

Pauropygus parvipetalus[1] H. L. Clark, sp. nov.

Plate 5, fig. 13–15.

Holotype.— Coll. B. W. A. 72. M. C. Z. 3,276. Spring Mount, St. James Parish.

Test 34.5 mm. long, 28.5 mm. wide, and 16.5 mm. high, very slightly thicker anteriorly than posteriorly, rather flattened both dorsally and orally, though the apical system is a trifle elevated; width of test about .82 of length and height is less than half. Genital pores large. Petaloid area small, 21 x 18 mm. or only .38 of the dorsal surface. Petals I and V are 9 mm. long by 5 mm. wide; II and IV

[1] parvipetalus = *having small petals*, in reference to the unusually small petaloid area.

are the same, while III is 11 x 5 mm. Interporiferous areas narrow (only about 1.5 mm.) with nearly parallel sides.

Peristome central. Periproct circular, 3 mm. in diameter, its posterior margin only 2 mm. from the test margin.

There are twenty-one specimens of this well-marked species, whose low test, submarginal periproct, and small petaloid area are very distinctive. The holotype is the largest specimen, while the smallest is only 10.5 mm. long by 9.5 mm. wide and 7 mm. high. It is interesting to note, although it is quite natural, that the small specimens are relatively high; the smallest has the height two thirds of the length, and a specimen 15.5 mm. has the height 9 mm. Adult specimens have the height about half the length or less.

The species was found only on a hillside at Spring Mount, St. James.

PAUROPYGUS PLATYPETALUS [1] H. L. Clark, sp. nov.

Plate 5, fig. 16–18.

HOLOTYPE.— Coll. B. W. A. 74. M. C. Z. 3,277. Western Jamaica.

Test 33 mm. long, 26 mm. wide and 18 mm. high, anteriorly; posterior end not so high; width of test about .80 of length and height about .54. Test flat above, somewhat gibbous below anteriorly and in middle of interambulacrum 5; not depressed around peristome; anterior end truncate; posterior end narrowed to a round-pointed form; this is just the reverse of what is shown in *ovumserpentis* and some other species. Madreporite moderate. Genital pores big. Petaloid area 25 x 21 mm. or about .60 of dorsal surface. Petals I and V 11 by 5.5 mm.; II and IV 9.5 x 6 mm.; III 11.5 x 5.5 mm.; all petals, short, wide and somewhat truncate.

Peristome central, more or less damaged. Periproct circular, 3 mm. in diameter, its posterior margin 4 mm. from the end of the test.

This unique specimen was gotten at the west end of the island but the exact locality is not known. It is much weathered so that the plates are smooth and the sutures very distinct. The color is pearl-gray. The very wide petals and the unusual form of the test combine to make this species a very well-marked one.

PAUROPYGUS PYRAMIDOIDES [2] H. L. Clark, sp. nov.

Plate 5, fig. 19–21.

HOLOTYPE.— Coll. B. W. A. 75. M. C. Z. 3,278. Hill west of Yallahs River, St. Thomas Parish.

[1] πλατύς = *wide* + πέταλον = *petal*, in reference to the exceptional width of the petals.
[2] πυραμιδοειδής = *pyramidal*, in reference to the unusual form of the test.

Test 25 mm. long, 19.5 mm. wide and 18.5 mm. high; width is thus .78 of length and height is .74. Test more or less pyramidal in side view, with apex excentric posteriorly, 14 mm. from anterior end of test. Genital pores not distinguishable. Petaloid area small, only 16 x 11 mm., or about .37 of dorsal surface. Petals I and V 8 mm. long and a little more than 3 mm. wide; II and IV 7.5 x 3 mm.; III 9 x 3 mm. Interporiferous areas wider than a single poriferous zone.

Lower surface of test nearly flat, a trifle gibbous anteriorly and a little depressed around peristome; peristome itself small, central, quadrangular; each ambulacrum except III is depressed below interambulacra at mouth, so that there are four furrows running out, one from each corner of the mouth. Periproct small, submarginal, 2.5 mm. wide and 2 mm. long; its posterior margin is little more than 1 mm. from posterior end of test.

There are only half a dozen specimens of this quite distinct species and they show little diversity in size, the smallest being 20 x 17 x 14 mm. In one specimen the genital pores are large and the apex is nearly central but whether this is a sex difference remains to be determined. This species was found in an eroded formation on the side of a hill west of the Yallahs River, St. Thomas Parish.

Pauropygus rotundus [1] H. L. Clark, sp. nov.

Plate 6, fig. 1–3.

Holotype.— Coll. B. W. A. 77. M. C. Z. 3,279. Vicinity of Spring Mount, St. James Parish.

Test 25 mm. long, 23 mm. wide and only 11 mm. high; width is thus .92 of length and height only .44. Apex central, a trifle raised above the flattened dorsal side. Genital pores small. Petaloid area small, 18 x 17 mm., or about .53 of dorsal surface. Petals with narrow poriferous areas and with interporiferous areas a trifle raised; petals I and V 7.5 x 3.5 mm.; II and IV 8 x 3.5 mm.; III 10 x 3.5 mm.

Peristome central only a little depressed. Periproct, 2.5 mm. wide by 2 mm. long, submarginal, its posterior margin less than 2 mm. from end of test.

There are only six specimens of this broad, flat species, all from the vicinity of Spring Mount, St. James Parish. They range in size from 18 x 17 x 9.5 mm. to 31.5 x 29 x 13.5 mm. The smallest specimen has very large genital pores and it looks as though the specimens with small pores were males. What evidence there is, suggests that in Pauropygus (not merely in the present species) there is a

[1] rotundus = *circular*, in reference to the nearly circular ambitus.

distinct sexual character in the size of the genital pores, females having large pores and males much smaller ones, but it may be that age and the degree of weathering are really the determining factors.

PAUROPYGUS RUGOSUS [1] H. L. Clark, sp. nov.

Plate 6, fig. 4–6.

HOLOTYPE.— Coll. B. W. A. 79. M. C. Z. 3,280. Yallahs River, St. Thomas Parish.

Test 31.5 mm. long, 29 mm. wide and 14 mm. high; width is thus .92 of length, while height is only .44. Dorsal surface flattened but rugose, the interporiferous areas and each column of interambulacral plates being elevated into low, rounded uneven ridges, which have flattened out at ambitus. Genital pores apparently wanting. Petaloid area large, 28 x 25 mm., or about .75 of the dorsal surface. Petals I and V 11.5 x 4.5 mm.; II and IV 11 x 4.5 mm.; III 16 x 4.5 mm.

Peristome central, with a sort of pseudofloscelle, at least anteriorly, but interambulacrum 5 shows no trace of a bourrelet. Periproct, 2.5 mm. wide and 2 mm. long, its posterior margin 3 mm. from end of test.

There are twenty-three specimens which seem more like the well-marked holotype of this species than they are like any of the other forms. But several of them are not very typical and one in particular is puzzling because it resembles so much the well-defined species *pyramidoides*. This specimen is 25 x 22.25 x 13.5 mm. and has the apical system elevated. In several specimens the genital pores are very large, while in the others they are moderate or small; only in the holotype are they hard to make out.

This species was found on both sides of the Yallahs River.

PAUROPYGUS STENOPETALUS [2] H. L. Clark, sp. nov.

Plate 6, fig. 7–9.

HOLOTYPE.— Coll. B. W. A. 82. M. C. Z. 3,281. Spring Mount area, St. James Parish.

Test 34 mm. long, 24 mm. wide, 12.5 mm. high anteriorly and 11.5 mm. posteriorly; width of test thus only .70 of length, and height scarcely .37. Dorsal surface quite flattened but interambulacra 2 and 3 are rather plainly elevated above the adjoining ambulacra. Petaloid area large, 29 x 21 mm., or almost .75 of dorsal surface. All the petals are very narrow, only 4.5 mm. wide; petals I

[1] rugosus = *rough*, in reference to the uneven surface of the test.

[2] στενός = *narrow* + πέταλον = *petal*, in reference to the unusually narrow petals.

and V are 13 mm. long, II and IV only 10 mm., and III 14 mm.; interporiferous areas very narrow, less than the width of one poriferous area.

Peristome large, central, pentagonal, 5 mm. across, distinctly sunken below on oral surface which is otherwise rather convex. Periproct circular, more than 3 mm. in diameter, little more than 2 mm. from the posterior end of test.

This specimen is much weathered especially on the dorsal surface and it is possible to attribute some of its peculiarities, especially of the petals, to that fact. But taken all in all it is a very well-marked form. Eleven other specimens are referred to *stenopetalus* but it must be granted that none of them have such narrow interporiferous zones, and as a rule the petals are wider and the petaloid area a little smaller; in some cases the dorsal surface is slightly arched.

Tarphypygus [1] H. L. Clark, gen. nov.

Type.— *Tarphypygus ellipticus*, sp. nov.

Similar to Oligopygus and Pauropygus in the form and general composition of the test, but with the periproct extraordinarily near the mouth and having the ambulacra without demiplates and widened at ambitus so as to exceed the interambulacra there. Coronal plates all with finely serrate margins, the teeth on one plate fitting into the notches of the adjacent plate, thus strikingly different from the straight sutures in Pauropygus. Ambulacral plates also with finely serrate margins, and, especially in midzone, with ends mortised together in the radial line, the upper half of each plate extending over the upper half of the next plate below in the other column.

This is certainly one of the most distinct and easily recognized genera among the Echini, for the characters which distinguish it are very unusual. The position of the periproct is approximated if not actually equalled in some others of the Exocycloida, but there is no genus in which the modification of the sutural union between the coronal plates is carried to the extreme shown in Tarphypygus, nor one where the mortising of the ambulacral plates along the radial line is so extraordinary. It is, of course, to be regretted that only two much-weathered specimens are available for study, for it is highly probable that the weathering has exaggerated the peculiarities of the sutures. The ambulacral expansion below the tips of the petals is very conspicuous in these weathered specimens, and of course results in the interambulacra being widest at the tips of the petals (hence on the dorsal surface) and narrowest at or below the ambitus. It is strange that the two specimens on which this genus is based represent two perfectly distinct species.

[1] $\tau\alpha\rho\phi\acute{\upsilon}\varsigma$ = *close* + *pygus*, in reference to the extraordinary nearness of the periproct to the mouth.

Tarphypygus ellipticus [1] H. L. Clark, sp. nov.

Plate 6, fig. 10–12.

Holotype.— Coll. B. W. A. 84. M. C. Z. 3,282. Hillside in Spring Mount region, St. James Parish.

Test 29 mm. long, 23.5 mm. wide and 19 mm. high; width is thus over .80 of length and height is about .65. Test well arched, highest at apical system and widest just anterior thereto. Finely serrate margins of coronal plates, and similar margins and mortised ends of ambulacral plates, conspicuously revealed by weathering of specimen. Ambulacrum I, at ambitus, is 9.5 mm. wide, interambulacrum 1 is 8.5 mm.; II is 9 mm. and 2, 8 mm.; III, 8.25 mm., 3, 8 mm.; IV, 9 mm., 4, 8.5; V, 9.5 mm., 5, 8.5. Petaloid area 22 x 19 mm., or a little more than .70 of dorsal surface. Petals I and V are 11 mm. long and 4 mm. wide; II and IV are 11.5 x 4 mm.; III 12 x 4 mm.; petals are widest near middle, not at tip; interporiferous area about as wide as the two poriferous together.

Peristome small, central, rounded pentagonal, 2.5 mm. across, little sunken below the convex oral surface. Periproct nearly circular, 1.5 mm. in diameter, its anterior margin only 1.5 mm. from posterior margin of peristome.

There is only a single specimen of this extraordinary sea-urchin and it was found in soft material, on a hillside in the Spring Mount region, St. James, where Pauropygus is so abundant. In interambulacra 1 and 4 near the peristome there are 2 or 3 small plates intercalated in the regular series. Ambulacrum V is similarly abnormal near the periproct. A careful examination shows that these supernumerary plates are not a specific character but merely an individual aberration. Nevertheless additional material for comparison is most desirable.

Tarphypygus notabilis [2] H. L. Clark, sp. nov.

Plate 6, fig. 13–15.

Holotype.— Coll. B. W. A. 85. M. C. Z. 3,283. Seven Rivers district, St. James Parish.

Test 25.5 mm. long, 22.5 mm. wide and 13 mm. high (posteriorly it is a little lower); width is thus about .90 of length and height about half. Test flattened above and below, with the serrate margins of the plates and the mortised ends of

[1] ellipticus = *elliptical*, in reference to the form of the ambitus.
[2] notabilis = *distinguished*, of obvious significance.

the ambulacral plates conspicuously brought out by weathering. Width of ambulacra I and V, just below ambitus, is 9 mm., with interambulacra 1 and 4, 7.5 mm.; II and IV are 8 mm., with 2 and 3, 7.5 mm.; III is 7.5 mm. wide, and 5 is 7 mm. Petaloid area 22 x 21 mm. or .80 of dorsal surface. Petals I and V are 11 mm. long by 4 mm. wide and II and IV are essentially the same; III is larger, 12 x 5 mm.

Peristome a little back of center but more or less concealed by matrix. Periproct very small, close to mouth; diameter less than 2 mm.; anterior margin only about 1 mm. from peristome.

That this species is congeneric with the preceding is obvious, and that it represents an entirely different species is equally evident when the specimens are compared. The most striking difference is in the form of the test, but the narrower interambulacra and the wider petal III may be mentioned. Other differences will be noted on comparison of the figures.

In this particular specimen there is a circular hole 1.5 mm. in diameter, 7 mm. from mouth on the line between ambulacrum V and interambulacrum 4; the surrounding plates are somewhat deformed; the test may have been perforated while still living by a boring mollusk.

CASSIDULIDAE.

Anisopetalus [1] H. L. Clark, gen. nov.

Type.— *Anisopetalus ellipticus*, sp. nov.

Test somewhat elongated, moderately high, with a transverse periproct situated high up on the posterior end, which is vertical or nearly so, being slightly overhung by interambulacrum 5. Petals long and narrow with poriferous areas unequal, as in Echinolampas, particularly in petals I and V where the inner area is much shorter than the outer; in II and IV the anterior area is shorter than the posterior; in III, the left hand area is the shorter. Oral surface more or less nearly flat but in smaller specimens may be more or less sunken around the peristome, especially in area 5. Phyllodes well developed but bourrelets not very conspicuous (in no available specimen, however, is the peristomal region in satisfactory condition).

This genus shows a curious combination of the characters of Echinolampas and Rhynchopygus. The form of the test and the position of the periproct are like the latter genus but the characters of the petals are those of the former. The

[1] ἄνισος = *unequal* + πέταλον = *petal*, in reference to the unequal poriferous areas in petals I and V.

peristome is more like Rhynchopygus but the difference in the bourrelets is quite evident. On the whole it might be said that Anisopetalus is a Rhynchopygus with the petals of an Echinolampas.

ANISOPETALUS ELLIPTICUS [1] H. L. Clark, sp. nov.

Plate 6, fig. 16–20.

HOLOTYPE.— Coll. B. W. A. 25. M. C. Z. 3,284. Western side of hills east of Montpelier, St. James Parish.

Test 50 mm. long, 39 mm. wide, and 20 mm. high; width of test, nearly .80 of length and height only .40. Outline of test elliptical but narrower in front than behind; thus while it is 39 mm. wide halfway between mouth and posterior end, it is only 30 mm. halfway between mouth and anterior end. Test well arched, sloping more rapidly anteriorly than posteriorly; it is highest at apical system and for some distance back of that, but the posterior end of the test is only 11 mm. high. Petaloid area rather more than 40 mm. long and rather less than 30 mm. wide or about .60 of the dorsal surface. Petals I and V with outer poriferous area about 24 mm. long, inner about 19 mm.; at middle, these petals are about 5 mm. wide, of which 3 mm. is occupied by the interporiferous area; at end of inner poriferous area the interporiferous area is only 1.5 mm. wide. Petals II and IV are also 5 mm. wide, of which the interporiferous area is 3 mm., but the posterior poriferous area is only 20 mm. long, the anterior only 16, and they are closer together at tip. Petal III is similar but a little narrower, with the right-hand poriferous area 20 mm. and the left-hand area 16 mm. There is but little difference in the number of pore-pairs (50–60) in the two sides of a petal, the difference in length being due chiefly to the size and degree of crowding of the pores. Apical system anterior, only 20 mm. from anterior margin of test.

Oral surface of test almost perfectly flat, with margins well rounded; peristome scarcely sunken, about 4.5 mm. long by 6 mm. wide, some 20 mm. from anterior end of test. Phyllodes well marked, the posterior pair about 4 mm. long by 3 mm. wide, with the outer sides only slightly convex; phyllodes II and IV a trifle shorter but with the sides more convex; phyllode III still shorter, with sides markedly convex. Bourrelets consist merely of a thick rounded margin to each interambulacral area; in interambulacra 2 and 3 this margin extends aborally so as to form a flattened, slightly sculptured, elevated area; in the other interambulacra, particularly 5, the sculpturing is so deep and extensive that the bourrelet consists only of the thick lip; lips thickly beset with small tubercles. Inter-

[1] ellipticus = *elliptical*, in reference to the form of the ambitus.

ambulacrum 5, adoral parts of the other interambulacra and ambulacrum 3 more or less deeply sculptured with circular, elliptical or irregular pits. Tuberculation of oral surface rather crowded, the tubercles largest adorally.

Periproct 7 mm. wide and 3 mm. high, but it is evident that pressure has exaggerated the disproportion between width and height; 6 x 3.5 mm. were probably the normal measurements; lower margin, much more nearly straight than upper, is nearly 7 mm. above ambitus; interambulacrum 5 seems to overhang the periproct as in Rhynchopygus but it is hard to decide whether this is not due, at least in large part, to postmortem pressure.

Besides the holotype, six specimens of this interesting species are at hand, but they are much smaller and are not so well preserved. They range from 26 to 41 mm. in length and show some slight diversity of form. On the whole the differences from the type are relatively insignificant. In the smallest specimen the posterior portion of the ambital region extends considerably beyond the periproct, so that in profile (Plate 6, fig. 20) this part of the test looks quite different from that of the others. The inequality of the poriferous areas in the various petals is well shown in all cases.

Asterostoma excentricum (Lamarck).

Clypeaster excentricus Lamarck, 1816. Anim. s. vert., 3, p. 15.
Asterostoma excentricum Agassiz & Desor, 1847. Ann. sci. nat., ser. 3, 7, p. 168.

Plate 7, 8.

This is apparently one of the commonest as well as one of the largest of the fossil Echini of Jamaica. It was found on the hillsides above the Yallahs River, St. Thomas, in the Lucky Hill region in St. Mary, and in the Spring Mount region, St. James. It probably occurs also on any of the high hillsides surrounding the Cockpit valleys, but unfortunately it seems very difficult to secure perfect specimens of the maximum size. It perhaps occurs most abundantly in the Lucky Hill region, where more than one hundred specimens were examined. Of these, only one was perfect, and, by curious fate, the Negro woman who owned this specimen had carefully and conscientiously carved the letters "G O D" deeply and cleverly into the side of the specimen.

The seventy-nine specimens at hand range from 48 x 37 x 26 mm. to 187 x 147 x 50 mm., but it should be noted that the smallest specimen is in very poor condition and the measurements are only approximate, while the largest specimen (Plate 7, 8) has been crushed by great pressure so that its present height is probably less than half what it was in life. In typical specimens the width is rather

more than three fourths the length (it ranges from .72 to .83) and the height is more than half (range usually .48–.61, exceptionally much more). There is considerable diversity of form due not merely to these differing proportions but to diversity in the position of the apical system. The most extreme case is a specimen 69 mm. long, 53 mm. wide and 51.5 mm. high; the greatest height is back of the apical system, over the mouth; the apical system is very far forward, only 20 mm. from the anterior end of the test.

While there is a completely-graded series from about 60 mm. in length up to 110 and a little more, there is a notable gap between these and the few large specimens exceeding 150 mm. in length. Unfortunately the large ones are all crushed and a careful comparison with the smaller ones is difficult, but there seems no satisfactory reason for considering them different species.

It is, however, an open question whether these specimens are really *excentricum* Lamarck, or at least whether they are identical with the Cuban species to which Cotteau gives that name. When compared with Cotteau's figures (1897. Bol. Com. mapa geol. España, **22**, pl. 20) differences are evident but it is well known that Cotteau's figures are not exact, so that most of these differences are probably insignificant. The difference in the proportion of the petal occupied by the interporiferous area is however very striking and suggests the possibility of two distinct species. The interporiferous area is very much wider in the Jamaican specimens than in Cotteau's figure of the dorsal surface but only actual comparison of Jamaican and Cuban specimens can determine whether this difference is real and constant.

In the Jamaican material the smaller specimens have the petals, especially the posterior pair, relatively shorter than the larger specimens. It looks as though the petals continued to increase in length as the animal grew; in the largest specimens they reach to the ambitus.

Echinolampas altissima [1] H. L. Clark, sp. nov.

Plate **9**, fig. 1–4.

Holotype.— Coll. B. W. A. 32. M. C. Z. 3,285. West side of Yallahs River, St. Thomas Parish.

Test 56 mm. long, 40 mm. wide and 40 mm. high; width and height are thus equal and about .87 of length. Test notably high and compressed, narrow in front, wide posteriorly; greatest width near tips of posterior petals; across anterior petals width is only 34 mm.; surface so weathered there is little trace of

[1] altissima = *highest*, in reference to the extraordinary height of the test.

tuberculation. Apical system at apex of test, its center only 19 mm. from anterior margin. Anterior end of test (and its sides) nearly vertical; posterior end slopes more gradually. Interambulacrum 5, which is elevated into a broad, rounded keel, overhangs periproct conspicuously at ambitus. Apical system small with 4 large genital pores quite near together and 5 somewhat smaller ocular pores. Petals I and V narrowly lanceolate, about 30 mm. long, 6.5 mm. wide at middle where widest (interporiferous area 4 mm. wide there) and 3 mm. at tip (interporiferous area 1.5 mm. there); petals II and IV similar in width but only 22 mm. long and hence appearing wider; petal III, notably small, only 15 mm. long, 4 mm. wide where widest and 3 mm. at tip. Inequalities in the poriferous areas are not conspicuous.

Periproct submarginal, under the conspicuously overhanging end of the keel in interambulacrum 5, about 6 mm. wide by 3.5 mm. high. Oral surface with each interambulacral area somewhat gibbous, most conspicuously so in 5; ambulacra thus a little depressed and peristome conspicuously sunken. Peristome about 26 mm. from anterior end of test and hence nearly central; its size and form more or less concealed by matrix; there is no satisfactory evidence of a floscelle.

Besides the holotype there are three other specimens of Echinolampas which seem to be identical with it. They were collected on the west side of the Yallahs River, St. Thomas Parish. Two are of about the same size as the holotype and resemble it closely but both have been somewhat damaged by pressure. The smallest specimen (Plate 9, fig. 4), however, shows some evident differences; it is 32.5 x 22 x 21.5 mm. and hence not nearly so wide or high proportionately as the holotype; furthermore it is not as narrow anteriorly nor as compressed in interambulacrum 5 as it should be; the periproctal region is damaged, unfortunately; oral surface quite like that of holotype and not at all like that of young specimens of *clevei*, the most nearly related Echinolampas.

There is no question that this species intergrades in the form of the test with *clevei*, of which it might be regarded as an extreme variety, but after examination of the large series of *clevei* it has seemed better to treat *altissima* as a distinct species. The character of the oral surface is distinctive and important, as in *clevei* the oral surface is nearly flat or somewhat concave.

Echinolampas anguillae Cotteau.

1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 24, pl. 4, fig. 6–8.

Hawkins includes this species in his manuscript list as from the Oligocene (white limestone) strata, but the present collection contains no specimens which can be identified as *anguillae*.

ECHINOLAMPAS BRACHYTONA [1] H. L. Clark, sp. nov.

Plate 9, fig. 5, 6.

HOLOTYPE.— Coll. B. W. A. 34. M. C. Z. 3,286. Near Guys Hill, St. Mary Parish.

Test 47 mm. long, 38 mm. wide and 23.5 mm. high; width is thus .80 of length but height is only .50. Test broadly ovate, narrowed posteriorly, much flattened, weathered so that the coarse tuberculation is indistinct. Apical system very small, with ocular and genital pores of about equal size, only 16 mm. from anterior margin. Petals I and V are about 22 mm. long, measured on the outer poriferous area, but the inner one is only about 14 mm. long; at end of inner area petal is 3.5 mm. wide but halfway to apical system it is 4 mm., of which half is made up of the interporiferous areas; petals II and IV are about 20 mm. long, on the posterior poriferous area, but the anterior area is little more than half as much (12 mm.); their breadth is slightly more than that of I and V; petal III is nearly 4 mm. wide, with the right-hand poriferous area about 16 mm. long and the left one scarcely 12. Periproct and peristome concealed in matrix which covers most of lower surface.

There are only two specimens of this species but it is so well characterized by the form of the test and the short poriferous areas on one side of each petal that it cannot be identified with any previously known form, nor does it seem to be very nearly allied to any of those hitherto known from the West Indian region. The paratype is only 34 x 28 x 22 mm. and is in poor condition but seems to be unmistakably this species. The second specimen was found in the Yallahs River valley, St. Thomas Parish.

ECHINOLAMPAS CLEVEI Cotteau.

1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 23, pl. 4, fig. 1–5.

Plate 9, fig. 7, 8.

This is the commonest Echinolampas in Jamaica. A series of 116 specimens range from 24.5 x 19 x 15.5 mm. up to 77 x 56 x 51.5 mm. They occur abundantly in the Spring Mount region, St. James, and also in the Yallahs River valley, St. Thomas. There is great diversity in the form of the test and especially in the shape of the petals but the great majority of specimens are easily identified. On the one hand, specimens very much like *lycopersicus* occur, while at the other extreme are others like *altissima;* thus a specimen 64 mm. long is 51 mm. wide and

[1] βραχύτονος = *reaching a short way*, in reference to the short poriferous zones, on one side of each petal.

36 mm. high, approaching *lycopersicus*, while another is 66 mm. long, only 47 mm. wide and 44 mm. high, much like *altissima*.

The most noteworthy specimen (Plate 9, fig. 7, 8) is quite unlike the others. It is 65 x 50 x 38 mm. and thus belongs to the *lycopersicus*-like series. It was collected in the vicinity of Lucky Hill in St. Mary, just south of Gayle, and was found at the base of a high escarpment, in which *Asterostoma excentricum* occurs in great abundance. It was the only specimen observed there, and no other like it was found, even though diligent search was made for others in various parts of the island.

Echinolampas lycopersicus Guppy.

1866. Quart. journ. Geol. soc. London, **22**, p. 300, pl. 19, fig. 8.

There are thirteen specimens referred to this species, ranging from 23 x 20 x 14.5 to 68 x 56 x 32 mm. The width of the test is .82–.88 of length, and the height ranges from about .47 of length in the large specimens to more than .60 in the smallest. The petals and petaloid area are large and characteristic. The sides of the test are well rounded and the oral surface is very slightly concave with the small peristome anterior in position. The species is readily recognized by the large petals with equal poriferous areas and the broad, more or less flattened anterior end of the test. The thirteen specimens are all from the Spring Mount region, St. James Parish.

Echinolampas paragoga [1] H. L. Clark, sp. nov.

Plate 9, fig. 9–13.

Holotype.— B. W. A. Coll. 38. M. C. Z. 3,287. Montpelier, Spring Mount region, St. James Parish.

Test 57 mm. long, 47 mm. wide and only 27 mm. high; width of test more than .80 of length but height less than one half. Specimen weathered and somewhat distorted by vertical compression. Apex of test quite evident, as test slopes away from it, especially on the sides. Apical system at apex which is only 23 mm. from anterior end. Petals I and V, with outer poriferous area 34 mm. long, distal pore-pairs well spaced, and inner area 24 mm. long; greatest width 6.5 mm., of which 3 mm. are for the interporiferous area. Petal II (petal IV is destroyed) with posterior poriferous area 28 mm. long, and anterior 23 mm.; width 7 mm., interporiferous area 4. Petal III, with right poriferous area 26 mm. long, left 23 mm., width 5.5 mm., of which interporiferous area is 3.5 mm.

[1] παραγωγή = *a variety*, in reference to its resemblance to *E. lycopersicus*.

Periproct marginal 7 x 4 mm. (somewhat damaged). Oral surface slightly concave. Peristome small, its center 23 mm. from anterior margin of test. Phyllodes well developed but bourrelets only moderately so.

Fifteen specimens are referred to this form which is readily distinguished from its ally, *lycopersicus*, by its higher, narrower test with a distinct apex, and the markedly unequal poriferous zones. In some specimens, the apex is much less conspicuous than in others and there is also diversity in the width of the petals. The smallest specimen is 29 x 22.5 x 18 mm. while the largest is 62 x 51 x 32 mm. The latter has the rear end damaged and the dorsal surface very flat (probably artificially depressed), so that its identification is not beyond question.

ECHINOLAMPAS STRONGYLA [1] H. L. Clark, sp. nov.

Plate 9, fig. 14–17.

HOLOTYPE.— Coll. B. W. A. 41. M. C. Z. 3,288. Seven Rivers region, St. James Parish.

Test 42 mm. long, 38 mm. wide and 23 mm. high; width is thus about .90 of length and height rather more than half. Specimen weathered and damaged anteriorly. Apex rather conspicuous owing to marked lateral slope from it; anterior and posterior slopes less marked; dorsal surface well arched; apex 17 mm. from anterior margin. Apical system at apex, large, not peculiar. Petals I and V with outer poriferous areas 22 mm. long, inner 16, and width of petal 6 mm., of which half is in interporiferous area. Petals II and IV with posterior poriferous area 21 mm., anterior 18 mm., and width 7 mm., of which a trifle more than half is interporiferous. Petal III 19 mm. long, 5.5 mm. wide, of which half is interporiferous, but the petal is incomplete.

Periproct marginal 6 x 3.25 mm. Peristome a little anterior to center; oral surface nearly flat but slightly concave; floscelle not conspicuous but area around peristome is imperfect.

There are fourteen specimens referred to the present species. They range in size from 26 x 23 x 17 mm. to 42 x 40 x 25 mm. No doubt this species is near to *paragoga* and to *lycopersicus* but the rounded form with ambitus nearly circular and the larger, wider petals, especially in young specimens, distinguish it from the former, while the form of the test and the inequality of the poriferous areas distinguish it from the latter. It may be that *lycopersicus*, *paragoga*, and *strongyla* are merely forms of a single variable species, but the lines between them are too evident to justify including them under a single name.

[1] στρογγύλος = *round*, in reference to the approximately circular ambitus.

PALAEOLAMPAS ALTA [1] H. L. Clark, sp. nov.

Plate 10, fig. 1–3.

HOLOTYPE.— Coll. B. W. A. 27. M. C. Z. 3,289. Easington, St. Thomas Parish.

Test 73 mm. long, 63 mm. wide and 39 mm. high; width is thus .86 of length and height is .53. Surface of test weathered so that the natural tuberculation remains only anteriorly on the oral side, where the tubercles are large, well-spaced but numerous (140–150 per square centimeter). Dorsal surface well arched, curving downward rather abruptly anterior to apical system, which is slightly excentric anteriorly, its center 32 mm. from margin of test; posteriorly the test slopes more gradually. Petals reaching nearly to ambitus, subequal and similar, with approximately equal poriferous areas, about 47 mm. long, 9–10 mm. wide near middle, 7 mm. or more at tip; interporiferous area about 5 mm. wide at middle and about 3 mm. at tip; petal III has the margins less curved and more nearly parallel than the others. Apical system defective; in other specimens there are 4 large genital pores and 5 ocular pores scarcely half as big.

Periproct marginal or barely submarginal, about 12 mm. wide by 8 mm. high. Oral surface nearly flat but somewhat depressed adorally; peristome about 5 mm. long by 9 mm. wide; its center 33 mm. from anterior end, hence it is slightly anterior in position; phyllodes well marked with the plates crowded, but bourrelets low and smooth, so the floscelle appears only moderately conspicuous.

There are forty-one specimens of this fine species, most of them in excellent condition. They range in size from 46 x 42 x 29 mm. to 88 x 73 x 52 mm.; the height may thus be nearly .60 of length. This is a very abundant fossil at Easington, St. Thomas Parish, where the strata seem to be of a more easily disintegrating sort than the strata in which larger fossils are generally found. It is also found in the Montpelier-Spring Mount district, in St. James Parish.

This species is not unlike *Echinolampas semiorbis* Guppy but the test is narrower and the periproct is much nearer the margin; the interporiferous areas are conspicuously narrower and the poriferous areas are more curved. But the two species are undoubtedly congeneric and resemble *Palaeolampas crassa* Bell, a Recent species of South Africa. On the whole, the study of the Jamaican material of *alta* and the following species, *plateia*, shows that it is desirable to accept Bell's genus Palaeolampas to include not only the type-species *crassa* but *semiorbis*, *alta*, and *plateia* also; and any other echinolampads with wide, equal petals, reaching nearly or quite to the ambitus. Conolampas is readily distinguished by

[1] altus = *high*, in reference to the form of the test.

the characteristic more or less hemispherical test, the central or posterior position of the peristome and the better developed floscelle. While there are possibly species which connect Palaeolampas with Echinolampas, so that the line between the two genera must be somewhat arbitrary, Echinolampas has become so large and unwieldy a group that its definition will be helped by recognizing the genus established by Bell.

PALAEOLAMPAS PLATEIA [1] H. L. Clark, sp. nov.

Plate 10, fig. 4–6.

HOLOTYPE.— Coll. B. W. A. 30. M. C. Z. 3,290. Montpelier, Spring Mount region, St. James Parish.

Test 98 mm. long, 83 mm. wide and 44 mm. high; width is thus about .84 of length and height is about .45. Surface weathered but tuberculation still quite distinct, about 150 tubercles per square centimeter. Test broadly oval, rather low, well arched but distinctly flattened at apical disk, from which the slope is even in all directions; 20 mm. anterior to mouth, width of test is 68 mm., but 25 mm. back of mouth, the width is 78 mm. Apical system with 4 genital pores but ocular pores indistinct; other specimens have the ocular pores nearly or quite as large as the genital. Apical system distinctly excentric anteriorly, only 43 mm. from anterior end of test. Petals reaching nearly or quite to the ambitus; petals I and V, about 58 mm. long, 13 mm. wide, 20 mm. from tip, 10 mm. wide at tip, the interporiferous area 8 mm. and 6 mm. at the same points. Petals II, III and IV about 50 mm. long, 11–12 mm. wide, where widest, and 8–9.5 mm. at tip; poriferous areas of III are much less curved than the posterior areas in II and IV; an interesting asymmetry is shown by the facts that petal II is only 25 mm. from III, 35 mm. from apex, while IV is 30 mm. from III at the same point. This asymmetry is evident to greater or less degree in all the specimens. It occurs also in *alta* but the flatter test of *plateia* makes it more conspicuous in this species.

Periproct submarginal, 7 mm. high by 11 mm. wide. Oral surface very slightly concave, uniformly tuberculated; tubercles are smallest near ambitus and largest near mouth. Peristome about 5 mm. long by 10 mm. wide; its center is 42 mm. from anterior end of test, hence it is distinctly anterior in position. Floscelle poorly indicated, neither phyllodes nor bourrelets being conspicuous; phyllodes about 10 mm. long by 6 mm. wide.

In addition to the holotype there are twenty-seven specimens, ranging from 50 x 44 x 26 mm. to 105 x 90 x 43 mm.; only in the smaller specimens does the

[1] πλατεῖα (feminine of πλατύς) = *flat*, in reference to the low test, as compared with that of *alta*.

height equal half the length. In addition to the specimens collected at the type-locality the species occurs also but less abundantly in the Yallahs River valley, St. Thomas.

While this species is evidently a near relative of the preceding it is easily distinguished by the more flattened form, which seems a constant difference. It must be admitted that there is no other reliable distinction. No doubt *plateia* is also nearly related to *semiorbis* but the narrower, flatter test and the closely submarginal periproct show it is a distinct species.

Parapygus antillarum (Cotteau).

Echinanthus antillarum Cotteau, 1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 26, pl. 4, figs. 9–12.
Parapygus antillarum Jackson, 1922. Carnegie Inst. Wash., Publ. 306, p. 56, pl. 9, figs. 6–9.

Plate 11, fig. 1, 2.

There are twenty specimens referred to this species, taken in the Spring Mount region, St. James. The rock in which they occur is rather soft and although the species seems to be common, even reasonably good specimens are hard to procure. Those at hand range from 33 x 26 x 19 mm. to 54 x 42 x 27 mm. The form and position of the periproct is very characteristic but there is very great diversity in the form of the petals; thus in one specimen petal II is 15 x 4.5 mm., in another it is 15 x 6.5 and in a third 17 x 9 mm. Cotteau's figures represent narrower petals than any in the Arnold collection, but Jackson's figures are, as always, accurate and reliable.

Parapygus parallelus (Cotteau).

Echinanthus parallelus Cotteau, 1897. Bol. Com. mapa geol. España, **22**, p. 53, pl. 12, fig. 8–13.
Parapygus parallelus Jackson, 1922. Carnegie inst. Wash., Publ. 306, p. 57.

This species is in Hawkins's manuscript list as occurring in "Eocene (yellow limestone)" strata, but is not among the Arnold material.

Rhynchopygus matleyi Hawkins, sp. nov.

1927. Mem. M. C. Z., **50**, p. 79, pl. 22, fig. 6–8.

Plate 11, fig. 3, 4.

This is one of the common fossil Echini of Jamaica and is found in all the parishes from which material has been studied. It is quite abundant in the Spring Mount region, St. James, less so in the Yallahs River valley, St. Thomas, and least frequent in the region of Lucky Hill and Gayle, St. Mary. There are 137 specimens at hand, ranging in length from 16 to 30 mm. There is much diversity in form and while some of this is no doubt due to artificial distortion by

pressure, it is evident that this species shows a considerable range in the proportions of width and of height to length. Thus a very perfect, though water-worn, specimen is 26 mm. long, 21 mm. wide and 12 mm. high; width is thus .80 of length, and height .46. Other specimens, however, are narrower, with width only .70 of length, while the height may be as much as .60. As an average, the width may be considered as three fourths and the height one half length. Hawkins's specimens seem to have been of maximum width. They were also extreme in the form of the periproct which he describes as "almost circular"; in very few of the present specimens is that the case; in the great majority the width is greater than the height — it may be 50 per cent greater. As Hawkins says, the overhang of interambulacrum 5 is slight and in worn specimens is wanting, but in the best preserved specimens it is perfectly evident, as a rule. There is relatively little diversity in the petals, the petaloid area occupying most of the dorsal surface in all cases. Hawkins refers to the subcarinate character of interambulacrum 5 orally, but his worn specimens did not show what is notable in unworn material, that this area is free from tubercles and is faintly sculptured with irregular short depressions and curved, low ridges.

Rhynchopygus punctatus [1] H. L. Clark, sp. nov.

Plate 11, fig. 5–7.

Holotype.— Coll. B. W. A. 24. M. C. Z. 3,291. West side of Yallahs River, south of Easington Bridge, St. Thomas Parish.

Test 21 mm. long, 16 mm. wide and 9 mm. high; width is thus .76 of length and height is .43. Test broadly rounded in front and behind, with lateral margins nearly parallel, highest anterior to apical system and sloping backward markedly to posterior margin; part of the postapical depression is undoubtedly artificial but evidently the test was normally lower there than in front. Apical system only 9 mm. from anterior margin. Petaloid area similar to that of *matleyi*, about 15 mm. long; petal III about 8 mm. long, the others about 6 mm.; all petals about half as wide as long; tips of petals I and V over 5 mm. from posterior margin of test.

Periproct 3.25 mm. wide, 2 mm. high; its posterior or lower margin is 5 mm. from margin of test; there is no overhang of interambulacrum 5 above the periproct, so the latter is completely visible from above. Oral surface somewhat concave, particularly back of the mouth. Character of peristome, which is very little anterior to center, obscured by adherent material but apparently similar to that

[1] punctatus = *having holes pricked in it*, in reference to the ornamentation of the oral surface.

of *matleyi*, only the bourrelets are not so conspicuous. Most of lower surface covered with large tubercles with deeply-sunken scrobicules, as usual in Rhynchopygus, but the median portion of area 5, which is distinctly depressed (and not at all carinate as in *matleyi*) bears no tubercles, but instead it is distinctly punctate, with numerous, deep, more or less circular pits .10–.25 mm. in diameter, without definite arrangement.

This species is aborally indistinguishable from *matleyi* but the oral surface is so strikingly different that there can be no doubt as to its specific value, even though the material is so scanty. The holotype is also suggestive of *R. depressus* Twitchell but the petals, the form and the "cribriform area" are all more or less different.

In addition to the holotype there is a paratype from an unknown locality. The paratype is a little smaller than the holotype, and has been broken across and the two halves crushed together. The mouth is distinctly anterior, periproct typical, and lower surface so weathered that the pitting is obscured; it seems, however, to have been like that of *punctatus*.

HEMIASTERIDAE.

Agassizia inflata Jackson.

1922. Carnegie inst. Wash., Publ. 306, p. 70, pl. 12, fig. 2–4.

There are twenty-nine specimens of Agassizia at hand, all from well up on the hillside above the Yallahs River, just above the bridge at Easington, St. Thomas, where they occur in debris, generally in very poor condition. They range in size from 11 x 9.5 x 8 mm. to 31.5 x 27 x 22 mm. and show little diversity in any way. The subconical upper surface is usually very noticeable and there is no reason to doubt that they represent this species, described by Jackson from a single specimen from the Eocene of St. Bartholomew.

Hypselaster perplexus [1] H. L. Clark, sp. nov.

Plate 11, fig. 8–10.

Holotype.—Coll. B. W. A. 100. M. C. Z. 3,292. Spring Mount, St. James Parish.

Test 28 mm. long, 25.5 mm. wide and 21 mm. high; width is thus .90 of length and height is .75. Test weathered so no tubercles or fascioles are visible, broadly rounded in front, with ambulacrum III hardly depressed at ambitus, narrowed and truncate behind, widest through or just posterior to the central apical system,

[1] perplexus = *puzzling*, in reference to our uncertainty as to the relationship of this species.

highest in interambulacra around apical system, which, with the adjoining parts of the ambulacra, is a trifle depressed. Ambulacrum III not petaloid. Genital pores only 2. Petals I and V 10 x 4 mm.; II and IV 13.5 x 4.5 mm.; outer end of II is a trifle defective.

Periproct very high up in rear end, high and narrow, 5 x 3.5 mm. Peristome very far forward, its anterior margin only 2.5 mm. from anterior end of test. Oral surface rounded, not much flattened. Labrum broad, low and inconspicuous.

There are eighty-six specimens of this puzzling sea-urchin, the generic and even family relationship of which is uncertain owing to the absence of any fascioles in the available material. The general appearance and the presence of only 2 genital pores suggest Hypselaster. It is possible that it is closely allied to *Prenaster loveni* Cotteau, but more and better material of that species will be necessary to settle the question.

The specimens at hand range from 16 x 12.5 x 12 mm. to 30 x 26 x 24.5 mm.; the width ranges from .78 to .90 of length and the height from .73 to .83. There is considerable diversity of form, from almost cylindrical with rounded ends to broadly ovate, with numerous intermediates. The widely-divergent petals II and IV, the absence of any depression in III, the high periproct and the very anterior position of the mouth are all distinctive characters.

This species is quite abundant in eroded hillside material at Spring Mount, St. James, and southward towards Point, but specimens in perfect condition are extremely rare, probably due to the delicate structure of the original test. It occurs in at least four different formations, in equally poor condition.

Linthia trechmanni Hawkins.

1924. Geol. mag., **61**, p. 319, pl. 18, fig. 6, 7.

There are three specimens of this species but all are in poor condition, crushed and distorted; one is 55 mm. long and 54 mm. wide, a second is 56 x 53 x 33 mm., with petals I and V 18 mm. long and petals II and IV 23 mm., and the third specimen is 60 x 65 mm. None of these specimens adds to our knowledge of the species. They were collected on hillsides west and south of Springfield, St. James Parish.

Periaster elongatus Cotteau.

1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 27, pl. 5, fig. 6.

This species is listed with a question mark by Hawkins (1924, Geol. mag., **61**, p. 312) from the yellow limestone of Spring Mount. There was but a single specimen in very poor condition. It is not represented in the present collection.

SCHIZASTER ALTISSIMUS [1] H. L. Clark, sp. nov.

Plate 11, fig. 11–13.

HOLOTYPE.— Coll. B. W. A. 103. M. C. Z. 3,293. Hillside on Yallahs River, St. Thomas Parish.

Length 52 mm., width 52 mm., and height, 48.5 mm.; width is thus equal to length and height is more than .93 of length. Test widest across apical system which is 21 mm. from anterior margin, and highest back of apical system in interambulacrum 5. There is evident distortion by pressure but no serious alteration in the form and proportions of the test is probable. Ambulacrum III is a narrow, deep groove, vertical on anterior end of test. Petals all seem to be closed grooves, I and V 20 mm. long, II and IV 25 mm.; there is no indication of ambulacral pores; whether the closed condition of the petals is due to artificial pressure cannot be determined; it is quite probable that the petals were deeply sunken as in Moira and under pressure the sides have been brought in contact with each other. No genital pores visible. Fascioles evident; peripetalous very broad and quite as usual in Schizaster; lateroanal also distinct but much narrower.

Periproct 7 mm. high by 3.5 mm. wide, its top 7 mm. lower than apex of test. Oral surface rounded, with plastron neither keeled nor flat. Peristome small, only 12 or 13 mm. back of anterior end of test. Tuberculation of test well preserved and quite as is Recent members of the genus.

Besides the holotype, there are two other specimens which seem to represent this species but they are so badly crushed and distorted by pressure that their identity is not beyond question; one of them is 56 x 40 x 47 mm. but the fact that the height is greater than width is obviously due to pressure; the other does not admit of satisfactory measurement. In these two specimens the petals are not like those of the holotype but the difference is probably artificial. All the specimens were found on the Yallahs River hillside, one and a half miles above the second bridge, in St. Thomas Parish.

SCHIZASTER BATHYPETALUS [2] H. L. Clark, sp. nov.

Plate 12, fig. 1–4.

HOLOTYPE.— Coll. B. W. A. 104. M. C. Z. 3,294. Spring Mount region, toward Seven Rivers, St. James Parish.

Test 57 mm. in greatest length, but only 54 mm. on the median III–5 axis,

[1] altissimus = *highest*, in reference to the unusual height of the test.

[2] *βαθύς* = *deep* + *πέταλον* = *petal*, in reference to the deeply-sunken petals.

owing to the depression at the ambitus of ambulacrum III; width 54 mm. and height 35.5; width is thus practically equal to length, while height is only two thirds as much. Test widest just back of tips of petals II and IV and highest just back of apical system, 30 mm. from anterior end. No genital pores visible. Ambulacrum III quite petaloid and deeply depressed, the petal 33 mm. long, 6 mm. wide, and fully 5 mm. deep; petals I and V 20 x 5 x 3 mm., and petals II and IV 27 x 4 x 4 mm. As the specimen is somewhat crushed and distorted by pressure, some of the narrowness and depth of the petals may be artificial.

Periproct high up, very large, but exact measurements cannot be given. Peristome anterior but more or less concealed by matrix; labrum only 15 mm. from anterior end in ambulacrum III.

There are twenty-four specimens which are referred to this species, distinguished by its proportions and the character of the petals. Unfortunately not one specimen is perfectly free from distortion and nearly all are in poor condition. In two specimens genital pores are present; in one case 2 pores are visible but the specimen is crushed almost flat; in the other case there is a pore in genital 1 and apparently also in genital 4; but it would not be safe to say on the strength of these two observations that *bathypetalus* has only 2 genital pores. In a specimen in fairly-good condition, 48 x 43 x 33 mm., the periproct is 9 mm. high by 7 mm. wide and is so high up in posterior end that the slope of the test towards the anterior end begins just above it.

This species was observed only in the region from Spring Mount, west and south toward Seven Rivers, St. James Parish. It is fairly abundant, but almost never in satisfactory condition. It occurs at fairly-low levels and the first specimen observed was secured from a woman cracking road-stones at the roadside. Road-stone is made from hard strata, which doubtless accounts for the poor condition of the eroded specimens.

Schizaster brachypetalus[1] H. L. Clark, sp. nov.

Plate 11, fig. 14–16.

Holotype.— Coll. B. W. A. 108. M. C. Z. 3,295. Near Abingdon, southwest of Green Harbour, Hanover Parish.

Test 30 mm. long, 28 mm. wide and 23 mm. high; width over .90 of length and height almost .80. Test well preserved but weathered; fascioles very difficult to trace but they seem to have been as usual in the genus. Apical system 20 mm. from anterior end of test but 5 mm. in front of the apex which lies on the low ridge

[1] *βραχύς* = *short* + *πέταλον* = a *petal*, in reference to the very short posterior petals.

in interambulacrum 5. Genital pores apparently only 2, one each in genitals 1 and 4. Test widest across apical system, narrowing rapidly posteriorly, more gradually anteriorly where it is well rounded, with only a faint indication of depression, at the ambitus in ambulacrum III. Petaloid area small; petals I and V are slightly depressed and only 6 mm. long by 3 mm. wide, fairly divergent, their tips 8 mm. apart; petals II and IV slightly depressed, about 9.5 by 4 mm., almost straight, not strongly divergent, their tips only about 16 mm. apart; petal III about 16 x 4.5 mm. rather deeply sunken at first but shallow distally.

Periproct, 4.5 mm. high by 3 mm. wide, just above the middle of the truncated, posterior end of test. Lower surface of test almost uniformly rounded, not even the plastron being flat; at posterior end of plastron, in midline, is a low rounded point but it is comparatively inconspicuous. Peristome about 4.5 mm. wide by 2.5 mm. long; labrum broken and anterior end gone; anterior edge of peristome only 7 mm. from anterior end of test.

There are 127 specimens of Schizaster which are considered examples of this species, characterized by test-form and by the very short posterior petals. These specimens range from 15 x 13 x 11 mm. to 34 x 33 x 25 mm. Several show the labrum which is lacking in the holotype; it is broad, well rounded and, seen from the side, low and inconspicuous. In two specimens the plastron is distinctly flattened but in the others it is rounded as in the type. There are five specimens which show clearly that there are only 2 genital pores in this species; in the largest the pores are very large, 1 mm. in diameter, so it is probable that that specimen was a female.

Other specimens were seen from the type-locality, but all of the paratypes are from St. James Parish, where it seems to be common.

Schizaster dumblei Israelsky.

1924. Proc. Calif. acad. sci., ser. 4, **13**, p. 141.

Plate **12**, fig. 5, 6.

There are seventeen Schizasters which are neither *brachypetalus* nor any other of the Jamaican species in hand. After considerable doubt, they are identified as *dumblei* Israelsky which was described from the San Rafael Beds, Tampico region, Mexico. There seem to be no tangible, constant characters by which to distinguish the Jamaican material, especially as that material shows considerable diversity in the petals. The two specimens figured show something of this diversity. The smallest specimen is 29 x 26 x 19 mm. and the largest is 64 x 51 x 45. All the material is from the Spring Mount district, St. James Parish, where it occurs commonly in badly-broken or crushed condition.

Schizaster dyscritus [1] H. L. Clark, sp. nov.

Plate 12, fig. 7–9.

Holotype.— Coll. B. W. A. 113. M. C. Z. 3,296. Seven Rivers district, St. James Parish.

Test 21 mm. long, 17 mm. wide and 12.5 mm. high; width is thus .80 of length and height .59. Test widest just back of tips of petals II and IV; highest in interambulacrum 5 just back of apical system, which is 9 mm. from anterior end. Ambulacrum III somewhat sunken adapically, but very little, if any, at ambitus. Petals I and V about 6.5 mm. long by 2 mm. wide, not much sunken; petals II and IV about 8 x 3 mm. shallow, diverging widely from the very base. Genital pores 2.

Periproct higher than wide, defective, very high up in truncate posterior end of test which is more or less defective. Peristome 4 mm. wide by 2 mm. long, its labrum low, flat and unimportant; anterior margin of peristome only 5 mm. from anterior end. Oral surface rounded but somewhat keeled along plastron.

This species is poorly characterized by the form of the test, the shallow, narrow petals and the general facies, and it is hard to make the distinction clear in words. Generally speaking, it may be said that the slightly-developed petals distinguish it from the other species of the genus found in Jamaica. It is even uncertain whether it should be considered a Schizaster.

Schizaster hexagonalis [2] H. L. Clark, sp. nov.

Plate 12, fig. 10, 11. Plate 13, fig. 1–3.

Holotype.— Coll. B. W. A. 115. M. C. Z. 3,297. St. James Parish, west of Springfield.

Test 48.5 mm. long (46 in median line through III–5), 45.5 mm. wide and 33 mm. high; width is thus nearly .94 of length and height is nearly .70. Test widest just back of tips of petals II and IV; highest in interambulacrum 5 back of apical system (the dorsal ridge in this interambulacrum has undoubtedly been exaggerated by pressure). Form of ambitus rounded hexagonal. Apical system not far from central. No genital pores visible. Petals I and V 20 mm. long and 5 mm. wide, considerably depressed, nearly parallel except at base; II and IV very widely divergent, 25 x 6 mm.; III not markedly petaloid, not much depressed at base but quite deeply sunken at ambitus. Peripetalous fasciole well developed,

[1] δύσκριτος = *hard to determine*, in reference to the doubt about the status of this species.

[2] ἑξ = *six* + γωνία = *angle, having six angles*, in reference to the characteristic form of the test.

following distal half of each petal quite closely; lateroanal fasciole not distinguishable.

Periproct about 8 mm. high and 5 mm. wide, very high up on posterior end. Peristome far anterior; no labrum present (damaged area). Oral surface, including plastron, well rounded.

There are thirteen specimens of this species and several of them throw additional light on the characters. In one the lateroanal fasciole can be distinguished in part. In another, the labrum is present and its tip is only 9 mm. from the margin of ambulacrum III. Most of the specimens are not so high as the type and in several the height is only half the length. In much-weathered specimens the petals are very conspicuous and even ambulacrum III becomes much more petaloid. The nearly central apical system, the large petals and the low, more or less hexagonal test, easily distinguish this species from its congeners. All the material is from the type locality, apparently in the harder strata.

SPATANGIDAE.

Antillaster arnoldi H. L. Clark, sp. nov.

Plate 15, fig. 3. Plate 16, 17.

Holotype.— Coll. B. W. A. 151. M. C. Z. 3,305. Near Spring Mount, west of the Springfield road, St. James Parish.

Test 165 mm. long, 128 mm. wide and 92 mm. high; width is thus .77 of length and height is .55. Apical system, defective, 67 mm. from anterior end of test; apex of test 15 mm. farther back and hence about central. Ambulacrum III little differentiated, very slightly depressed at ambitus but not adapically. Petals I and V about 120 mm. long, 20 mm. wide at middle, of which half is interporiferous, 24 mm. wide where widest (24 mm. from tip), of which 13 mm. is interporiferous; open by 9 mm. at the somewhat narrowed tip, where poriferous areas curve in markedly; anterior poriferous area ends 20 mm. from ambitus; posterior poriferous area ends 25 mm. from ambitus. Petals II and IV 90 mm. long, 19 mm. wide at middle, of which half is interporiferous, 22 mm. wide where widest (22 mm. from tip); open by 9 mm. at tip, where 14 mm. wide; anterior poriferous area nearly straight, posterior more evidently curved; both end about 25 mm. from ambitus.

Periproct damaged but very large and supramarginal. Oral surface flat with well-rounded margins; peristome sunken fully 10 mm. below it; labrum rather small but 5 mm. long, its tip 50 mm. from anterior margin of test.

Only a single specimen of this huge species was seen, and it is much weathered

so that no fascioles can be detected. It is evidently closely related to *Eupatagus vaughani* Jackson, which Sanchez Roig (1926, Bol. de minas, Habana, no. 10, p. 98) puts in Lambert's Antillaster. This genus seems both valid and desirable as it helps much toward a proper arrangement of the heterogeneous lot of species hitherto included in Eupatagus. From all of the previously-known species of Antillaster, *arnoldi* is easily distinguished by the great width of petals and interporiferous zones, and the form of the test. It seems most appropriate that it should bear the name of the man whose indefatigable collecting has added so much to our knowledge of Jamaican fossil Echini.

The holotype was found by a woman near Spring Mount, who stated that she got it from a stone-wall around her garden, where it had doubtless existed for a generation or more. The garden-wall is on a small, fairly-level area on the eastern side of the range of hills west of the Springfield road, St. James Parish, and the wall was built from loose stones picked up in the immediate vicinity. There is apparently no evidence to indicate the location of the strata from which the specimen came, but naturally it is from a higher elevation and gradually worked down to the garden-region in which it was found. The fact that the specimen is in very good condition indicates that it has not moved far from its place of origin, and it would therefore seem probable that it originated at a point not very high above the garden and not very far up the hill. The specimen is quite the highest and perhaps the heaviest of any Jamaican echinoid, is apparently unique, and no smaller specimen resembling it has been seen.

Brissus brissus (Leske).

Spatangus brissus (var. *unicolor*) Leske, 1778. Add. ad Klein, p. XX, 182.
Brissus brissus H. L. Clark, 1917. Mem. M. C. Z., **46**, p. 218.

A single specimen of a Brissus was found in debris at the base of a cliff in the vicinity of Lucky Hill, St. Mary Parish. It is 51 mm. long, 42 mm. wide and 31 mm. high. It is much weathered, so that no fascioles can be made out, and only on the ventral surface are any tubercles still preserved. Comparison with a bare test, of the same size, of the Recent species *Brissus brissus*, which is common along the coast of Jamaica, shows no appreciable differences.

Eupatagus alatus[1] H. L. Clark, sp. nov.

Plate 13, fig. 4–7.

Holotype.— Coll. B. W. A. 141. M. C. Z. 3,298. West of Springfield toward Seven Rivers, St. James Parish.

[1] alatus = *winged*, in reference to the appearance of the anterior paired petals.

Test 73 mm. long, 66 mm. wide, and 30 mm. high; width is thus about .90 of length and height is only about .40; the specimen is however crushed and hence the height is abnormally low. Test rather evenly rounded, highest in interambulacrum 5 back of apical system, which is only 26 mm. from anterior end, and has 4 genital pores very close together. Ambulacrum III not noticeable, hardly depressed even at ambitus. Petals I and V 32 mm. long, 9.75 mm. wide, with interporiferous areas 6 mm. across, tips of petals closed; petals II and IV 30 x 10 mm., the interporiferous area 6 mm. across near base, where widest; posterior poriferous area nearly straight but curving a little towards the front, especially near tip; anterior poriferous area runs nearly straight forward at first and then sweeping outward in a fine curve nearly meets the posterior area at tip of petal, which is not however quite closed.

Periproct damaged. Oral surface flat. Peristome concealed.

There are 243 specimens referred to this species but none of the others is nearly so large as the holotype and the great majority are 30–50 mm. in length. They range in size from 16 x 13 x 9 mm. to 52 x 44 x 28 mm. There is considerable diversity in the width of the test, for while many are as wide as the holotype in others the width of the test is less than .80 of length. The normal height of specimens not artificially depressed is a little more than half the length; the height posteriorly is often much greater than at or in front of apical system; thus the specimen with maximum height of 28 mm. is only 24 mm. in front of apical system. In all the specimens, however, the wing-like anterior petals are well shown and the species is easily recognized by the combination of this character with the wide, flat test. In undamaged specimens, the periproct is high and narrow, the shape of an apple-seed, with the point adoral; its height is 6 mm. in a specimen 30 mm. long, and its breadth not quite 4; in this specimen, it is visible from above; probably it would not be in full-grown specimens. Peristome flush with oral surface, 5 mm. wide and 4 mm. long in this 30 mm. specimen, with no evident labium; its anterior margin is about 8 mm. from anterior end of test.

All the specimens of *alatus* were collected in St. James Parish.

Eupatagus antillarum (Cotteau).

Euspatangus antillarum Cotteau, 1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 43; pl. 7, fig. 8–12.
Eupatagus antillarum Guppy, 1882. Sci. Assoc. Trinidad, Proc., pt. 12, p. 199.

This species was described from the St. Bartholomew Eocene limestone but Hawkins (1924, Geol. mag., **61**, p. 322) has recorded it doubtfully from the yellow limestone at Glasgow, St. James Parish, Jamaica. His specimen was much worn

and he does not actually identify it as *antillarum*. Only one of the numerous specimens of Jamaican Eupatagus in the Arnold material can be referred to this species and this was found near Point on the Springfield road, St. James Parish. Its occurrence there adds to the probability of Hawkins's identification being correct. The Arnold specimen is 45 mm. long, 37 mm. wide, 19 mm. high anteriorly and 21.5 mm. high in interambulacrum 5. It agrees well with Cotteau's description and with Jackson's figures 5 and 6 (1922, Carnegie Inst. Wash., Publ. 306, pl. 16). The other specimen figured by Jackson is, as he suggests, not *antillarum*.

EUPATAGUS ATTENUATUS [1] H. L. Clark, sp. nov.

Plate 13, fig. 8, 9.

HOLOTYPE.— Coll. B. W. A. 147. M. C. Z. 3,299. Vicinity of Seven Rivers, St. James Parish.

Test 62 mm. long, 52.5 mm. wide and 21.5 mm. high; width is thus .85 of length and height about .35. Test badly weathered, rear end damaged and oral surface in bad condition. Greatest width is just back of anterior petals, while at tips of petals I and V width is only 35 mm.; greatest height at extreme rear of interambulacrum 5. Ambulacrum III is not depressed, except slightly at ambitus. Apical system anterior, only 27 mm. from anterior end of test. Petals I and V 28 mm. long, 8.5 mm. wide, interporiferous area 4 mm. wide; outer poriferous area widely arched; petals II and IV 24 mm. long, 7 mm. wide, interporiferous area 3.25 mm., very widely divergent, attenuate and curved forward at tip.

This species is so well marked by the shape of the test and the striking anterior petals that it is named, even though there is but a single specimen and that in poor condition.

EUPATAGUS DEFECTUS [2] H. L. Clark, sp. nov.

Plate 14, fig. 1–3.

HOLOTYPE.— Coll. B. W. A. 148. M. C. Z. 3,300. Spring Mount region, St. James Parish.

Test 37 mm. long, 35 mm. wide and 15 mm. high; width is thus almost .95 of length, while height is only .40. Greatest width anterior to apical system; greatest height in interambulacrum 5, between tips of petals I and V; anteriorly height is only 12 mm. Apical system anterior, only 14 mm. from anterior end of test, with the 4 genital pores very close together. Ambulacrum III depressed,

[1] attenuatus = *diminished*, in reference to the gradual narrowing of the long petals II and IV.
[2] defectus = *deficient*, in reference to the absence of pore-pairs at base of petals II and IV.

well-marked but anterior furrow shallow even at ambitus. Petals I and V 15 mm. long, 5.25 mm. wide, interporiferous area only 2 mm. wide, closed at tip; petals II and IV 14 x 6 mm., closed and pointed at tip; posterior poriferous area nearly straight; anterior area strongly convex, the proximal half dozen (or more) plates without conspicuous pore-pairs.

Periproct large, high up on posterior end of test, damaged. Peristome about 12 mm. from anterior end of test, wide and short, 7 mm. x 3, with a fairly-well-developed, but not conspicuous, labium. Oral surface flat with practically no keel on plastron.

There are twenty-two specimens referred to this species. The slight development of the pore-pairs in the proximal part of the anterior poriferous area of petals II and IV is of course very common in Eupatagus but in none of the other Jamaican species is the feature as conspicuous as in *defectus*. This characteristic, combined with the low, wide test and the depressed ambulacrum III, makes the species readily recognizable. There is some diversity in the shape of test, especially as regards the elevation of interambulacra 2 and 3 on either side of petal III; in a few specimens this elevation is conspicuous so the test is highest at those points, and it may even include the basal part of petals II and IV; but usually it is not conspicuous and in some cases it is very slight. Another point in which considerable diversity is shown is the width of the poriferous areas, especially the anterior area of petals II and IV, but in general the poriferous areas are conspicuously wide. The range of measurements is from 21.5 x 19 x 9.5 mm. to 40.5 x 38.5 x 19 mm. but the largest specimens are in poor condition; one of them is notable, however, for very wide petals, 15 x 6.5 or 7 mm. A specimen 31 mm. long is 16 mm. high but this is, of course, an extreme case. All the material is from the Spring Mount region in St. James Parish.

Eupatagus hildae Hawkins, sp. nov.

1927. Mem. M. C. Z., **50**, p. 81, pl. 22, fig. 9, 10.

None of the Arnold material seems to resemble this species, which is known from only a single specimen taken near Brown's Town, Parish of St. Ann. Whether it is identical with or distinct from Jackson's "species A" (1922, Carnegie inst. Wash., Publ. 306, p. 90) can only be determined when more material is available. The specimen described by Jackson is from an unknown locality in Jamaica and is quite different from any Eupatagus in the present collection.

Eupatagus longipetalus[1] H. L. Clark, sp. nov.

Plate 14, fig. 4–6.

Holotype.— Coll. B. W. A. 150. M. C. Z. 3,301. West side of the Yallahs River, St. Thomas Parish.

Test 53 mm. long, 48 mm. wide and 22 mm. high; width is thus about .90 of length and height is rather more than .40. Left anterior quarter of test is somewhat crushed and the posterior end is damaged so that no information about the periproct has any value; the oral surface is almost flat, the plastron barely keeled; there is some depression about the peristome, but it is occupied by matrix. Apical system 21 mm. from anterior end of test, with 4 large genital pores placed close together. Test highest in interambulacrum 5, well back of the apical system; near anterior end height of test is only 19 mm. Ambulacrum III not petaloid and not depressed. Petals very long, flat, and narrow; I and V are over 30 mm. long and hardly 5 mm. wide, of which the interporiferous area is less than half; petals II and IV are 25 x 5.5 mm., the interporiferous area half the width.

This unique specimen found near the "short cut" road to Kingston, although in poor condition, shows characteristic features so evident that it requires a distinctive name.

Macropneustes and Plagiobrissus.

In this Jamaican material there are representatives of half a dozen or more species clearly related to *Macropneustes antillarum* (Cotteau), or *Plagiobrissus loveni* (Cotteau). These specimens are usually large, poorly preserved, and often hardly more than fragmentary. In an effort to make satisfactory disposition of this very difficult material it becomes evident that the genera Macropneustes and Plagiobrissus are confluent; or perhaps it would be better to say that the material at hand does not furnish any satisfactory line between them. It seems better therefore to make a purely arbitrary distinction, putting in Macropneustes three forms which have high tests and no conspicuous primary tubercles, and relegating to Plagiobrissus all the rest of this perplexing material. Of one species of Plagiobrissus (*loveni*) there is enough material in good condition to form a correct understanding of that species but this is not the case with any other of the species listed. The Recent species of Plagiobrissus form a sharply-defined genus and it is not unlikely that *P. loveni* is genetically related to them, even though it is doubtful whether it should be treated as congeneric. But the only reason for treating the other forms as Plagiobrissus is that their actual generic position is quite

[1] longipetalus = *having long petals*, in reference to that characteristic feature.

indeterminable, and they are apparently as nearly related to *P. loveni* as to any other Echini.

It should be noted therefore that the species listed as Macropneustes and Plagiobrissus are not regarded as actually members of those genera, excepting possibly *Plagiobrissus loveni*, but they are so treated here purely as a matter of convenience until more and better material shall enable the determination of their true relationships.

Macropneustes altus [1] H. L. Clark, sp. nov.

Plate 14, fig. 7–9.

Holotype.— Coll. B. W. A. 122. M. C. Z. 3,302. Western side of the Yallahs River, St. Thomas Parish.

Test more than 82 mm. long, 66 mm. wide and 51 mm. high, so badly damaged at rear end that the periproct is wanting and the actual length of the test cannot be determined. Apical system excentric anteriorly, only 31 mm. from anterior end of test; genital pores 4, distinct. Test widest back of apical system and highest in the same region; there are no indications of large primary tubercles or of fascioles.

Ambulacrum III sunken but not at all petaloid. Petals I and V very long, 55 mm., and only 8.5 mm. wide, reaching to ambitus; petals II and IV, 40 x 7.5 mm., very markedly divergent, not quite reaching ambitus. Interporiferous areas not quite so wide as one poriferous. Oral surface nearly flat, but median area of plastron a little elevated. Peristome somewhat more anterior than apical system, only 25 mm. from anterior end of test.

This unique specimen was found on a hillside on the western side of the Yallahs River, above the second bridge. The combination of test form, length and direction of petals and very narrow interporiferous areas distinguish it from the other perplexing specimens in this group.

Macropneustes angustus [2] H. L. Clark, sp. nov.

Plate 14, fig. 10, 11. Plate 15, fig. 1.

Holotype.— Coll. B. W. A. 123. M. C. Z. 3,303. Spring Mount region, St. James Parish.

Test 98 mm. long, 60 mm. wide and 60 mm. high, distorted, weathered and damaged; normal height probably about 50 mm., exaggerated by compression,

[1] altus = *high*, in reference to the distinctive form.
[2] angustus = *narrow*, in reference to the compressed test.

which has, of course, also diminished the width. Ambulacrum III scarcely sunken, but most of it is lacking as anterior end of test is gone. Petals I and V are about 60 mm. long by 7–8 mm. wide, rather deeply sunken; their distal ends are hardly 40 mm. apart. Petals II and IV are opposite each other, but are a little curved, so that the middle of each is nearer petals I (or V) than it is to III; they run almost vertically down the sides of the high test. The specimen shows no apical system, periproct, peristome, or oral surface.

Besides the holotype there are three other specimens. One is a mere fragment 31 x 30 mm. showing the petals and anterior end; it seems to have been widened by pressure but the anterior petals look very much like *angustus*. A second specimen is about 80 mm. long and nearly or quite 75 mm. wide; no estimate of the height is practicable; petals II and IV diverge so widely they are actually nearer to I and V than to III; all petals except III are deeply sunken, III only slightly so; there are 4 big genital pores.

The third and most interesting of the specimens (Plate 14, fig. 10, 11) is from a very different kind of rock, almost black but, where much weathered, it is dull red, presumably from iron in the rock. It is 60 mm. long, only 30 mm. wide and 50 mm. high; no doubt part of this extraordinary form is due to pressure but there can be no question that the animal was in life narrow and high; the anterior end is quite vertical; petals II and IV are almost straight up and down the sides; nothing is shown of the apical system or of the normal structure of the rear end or of the oral surface. This specimen appears at first sight so different from the others that it is with hesitation considered the same; there seems, however, no satisfactory character by which it may be distinguished. It was collected in the Spring Mount region, St. James Parish, while the other material is all from western hillsides of the Yallahs River valley, above the second bridge in St. Thomas Parish.

Macropneustes parvus[1] H. L. Clark, sp. nov.

Plate 18, fig. 1–3.

Holotype.— Coll. B. W. A. 119. M. C. Z. 3,306. Near Johns Hall, Springfield road, St. James Parish.

Test 17 mm. long, 15 mm. wide and 13 mm. high; width is thus .88 of length and height is .76. Apical system only 5 mm. from anterior end of test. Apex of test in interambulacrum 5 about 3 mm. back of apical system. Ambulacrum III almost vertical, subpetaloid for 6–7 mm. from base, distinctly sunken at ambitus.

[1] parvus = *small*, as it is much the smallest species yet referred to this genus.

Petals I and V about 8 mm. long by 2.5 mm. wide; II and IV opposite each other, at right angles to long diameter of test, 7 x 2.3 mm.

Periproct about 4 mm. high by 2.5 mm. wide, near upper margin of posterior end of test. Oral surface somewhat rounded with peristome far forward, only 4–5 mm. from anterior margin of test.

There are two other specimens besides the holotype, one measuring 17 x 15 x 11 mm., the other 23 x 19 x 16 mm. In the smaller one the test is highest in interambulacra 2 and 3 in front of the apical system and ambulacrum III is scarcely sunken at all. The larger specimen is essentially like the holotype. These three little Echini are surprisingly like certain small specimens of *Metalia sternalis*, a Recent Indo-Pacific species, and it seems probable that they are still young. They apparently have only 2 genital pores, but in no specimen is the apical system uninjured. They certainly resemble *Macropneustes angustus* and are perhaps the young of that species.

Meoma antiqua [1] H. L. Clark, sp. nov.

Plate 15, fig. 2.

Holotype.— Coll. B. W. A. 121. M. C. Z. 3,304. Near Lucky Hill, St. Mary.

Length of badly-damaged specimen, 80 mm., width more than 62 mm. and height 35 mm. more or less. There is no oral surface and the anterior part of the test is also missing; lateral margins and rear end also badly damaged; enough remains of the rear end to show that the periproct was large and located there. Upper surface of test somewhat flattened but with interambulacra 2 and 3 well arched anteriorly. Ambulacrum III apparently not depressed and certainly not petaloid. Petals I and V, 40 mm. long by 8 mm. wide, quite deeply sunken; petals II and IV, nearly 40 x 8 mm., deeply sunken. Around tip of IV and across interambulacrum 4, a part of the peripetalous fasciole is present. Tuberculation rather coarse but there are no large tubercles as in Plagiobrissus.

This specimen is quite different from any of those referred to Macropneustes and Plagiobrissus, and the fragment of a fasciole enables its identification as a Meoma. Comparison with a specimen of *Meoma ventricosa* of about the same size shows that the fasciole as far as visible is exactly like that of *ventricosa*. On the other hand the petals and the apparent form of the test indicate that it is not that species. The specimen was found in debris at the base of vertical cliffs, visible as one approaches from the Claremont Road.

[1] antiqua = *ancient*, in reference to its being one of the oldest species of the genus.

PLAGIOBRISSUS ABRUPTUS[1] H. L. Clark, sp. nov.

Plate 18, fig. 4, 5.

HOLOTYPE.— Coll. B. W. A. 126. M. C. Z. 3,307. Spring Mount region, St. James Parish.

Test 87 mm. long (82.5 mm. when measured through III–5 in the median line), 82 mm. wide and 40 mm. high; width is thus almost .95 of length while height is only a little over .45. Apical system excentric posteriorly, 47 mm. from anterior end of test, slightly depressed. Apex of test in interambulacrum 5, back of apical system, but the adjoining interambulacra are nearly as high. Test slopes forward from the apex gradually, but to the rear it slopes very abruptly. Ambulacrum III not petaloid but deeply depressed, especially at ambitus. Petals I and V remarkably long, over 50 mm., reaching ambitus; width about 9 mm., of which the interporiferous area is less than a third. Petals II and IV, over 50 mm. long, reaching nearly to ambitus at a point only about 15 mm. from anterior end of test; width about 8.5 mm.; tips open and truncate, not narrowed and rounded as in the following species (*elevatus*). Posterior end of test damaged and oral surface buried in matrix. Tuberculation of test, so far as preserved, rather coarse; in the anterior interambulacra, dorsally, each plate carries 8–10 large tubercles, chiefly on its upper half, the lower half being quite free from them; ends of plates adjoining ambulacrum III pretty uniformly covered with smaller tubercles.

There are eighteen specimens assigned to this species but most of them are in such very poor condition that their identification is by no means trustworthy. They range in size from 68.5 x 66.5 x 32 mm. to 97 x 82 x 45 mm. The largest specimen and several others are distorted by pressure. The posterior position of the apical system, the long narrow petals and the more or less truncate rear end of the test make a typical specimen easy to recognize.

PLAGIOBRISSUS ELEVATUS[2] H. L. Clark, sp. nov.

Plate 19, fig. 2–4.

HOLOTYPE.— Coll. B. W. A. 128. M. C. Z. 3,308. Near Spring Mount, St. James Parish.

Test 110 mm. long, 93 mm. wide and 48 mm. high; width is thus .85 of length, and height .44. Apical system only slightly posterior, 57–58 mm. from anterior end of test. Apex of test anterior to apical system, in interambulacra 2 and 3, whence it slopes at first slightly and then rather rapidly to rear-end. Ambulacrum

[1] abruptus = *precipitous*, in reference to the truncated appearance of the rear-end.
[2] elevatus = *raised*, in reference to height of test as compared with *P. loveni*.

III not petaloid, very little sunken at base but becoming markedly depressed at ambitus, so there is a conspicuous notch there. Apical system and petals I and V are too badly damaged to show very much character; I is wholly wanting but V is present in part, enough to show that it was long, reaching nearly or quite to ambitus, with a moderately wide interporiferous area. Petals II and IV very long, extending widely outward, and slightly forward, nearly reaching ambitus; length almost 70 mm., width at middle 8.5 mm. but nearer the tip, 10 mm., of which nearly 4 mm. is interporiferous; anterior poriferous area nearly straight, posterior more definitely curved.

Periproct and rear end of test damaged. Peristome anterior, more sunken than in *P. loveni*, the rather conspicuous labium about 30 mm. from anterior end of test.

The holotype was found on a hillside above the road, on the west side. It is easily distinguished by the form and proportions of test and petals. A second specimen, probably this species, is badly distorted and crushed, so that the identification is open to question. It is 116 x 90 x 35 mm. and shows no additional features, except that the tuberculation of the anterior part of the dorsal surface is shown; it resembles closely that already described for *P. abruptus*.

Plagiobrissus latus[1] H. L. Clark, sp. nov.

Plate 18, fig. 6, 7. Plate 19, fig. 1.

Holotype.— Coll. B. W. A. 130. M. C. Z. 3,309. Springfield road, near Point, St. James Parish.

Test 80 mm. long (only 73 mm. through III–5 in the median line), 80 mm. wide or a trifle less, and 33 mm. high; the width is thus practically equal to the length while the height is only about .40 as much. Apical system approximately central, slightly depressed; test highest in surrounding interambulacra, especially in 2 and 3, and in 5 halfway to posterior end of test. Petals rather depressed, as is ambulacrum III, which is not at all petaloid but is so depressed at ambitus as to form a notch some 7 mm. deep there; petals I and V wide, their width about one fourth of their length, widely divergent, rounded at tip, interporiferous area narrow; petals II and IV very similar, but perhaps a little longer.

Periproct and general aspect of lower surface much as in *loveni*, but peristome more anterior; labium only 16 mm. from ambitus in ambulacrum III, or .20 of test length; in *loveni* the distance is about .25 of length.

The single specimen of this species, which was found in debris near a hilltop,

[1] latus = *wide*, in reference to the distinguishing feature of the species.

while evidently closely related to *loveni* shows differences in shape of test, in position of peristome and in posterior petals which separate it easily from that species.

Plagiobrissus loveni (Cotteau).

Plagionotus loveni Cotteau, 1875. Kongl. Sven. vet. akad. Handl., **13**, no. 6, p. 11, pl. 8, fig. 7, 8.
Plagiobrissus loveni Jackson, 1922. Carnegie inst. Wash., Publ. 306, p. 83, pl. 14, fig. 5.

Plate 20, fig. 1–5. Plate 22, fig. 11–13.

There are 116 specimens of this species hitherto most imperfectly known from a single fragmentary specimen. Thanks to Jackson's excellent figure, the identification of this material is confirmed; it was collected in St. James Parish, chiefly along the Springfield road, near Point. Most of the specimens were found in the earth of the banana fields.

Hawkins had four specimens from Ginger Valley, near the Trelawney boundary of St. James, but owing to their more or less imperfect condition he failed to note their resemblance to *P. loveni*, and decided they were a new species of Macropneustes, further evidence of the worthlessness of the distinctions supposed to separate the two genera. Hawkins's kindness in sending photographs and one of his specimens proved that his material is identical with the Arnold series.

The specimens range from 46 x 38 x 21 mm. to 115 x 98 x 37 (posteriorly). The relative width ranges from .78 to .88 of length, while the height has an even greater range, .32–.45 of length. No doubt in many, perhaps most, of the specimens, whose height is much less than .40 length, there has been artificial flattening through pressure, but there are some specimens which seem to be perfectly preserved whose height is only about .35 of length. As a rule the smaller the specimen, the greater its relative height. The anterior end is considerably lower than the posterior, the difference being due in large part to the median ridge of the plastron which is greatest at the rear-end, culminating a few millimeters in front of the subanal plastron. In very few specimens is it possible to determine the size and form of the subanal plastron, as the limiting fasciole is usually entirely wanting, owing to the weathering of that end of the test. But now and then this part has in some way been protected from weathering and it is possible to make out these important features. In a perfectly-preserved specimen 70 mm. long, the subanal plastron, bounded by a complete fasciole, is about 30 mm. wide and 12 mm. long, bending up on each side of the periproct as in Brissus, and including 5 enlarged pore-pairs on each side. It is thus not at all like the same area in *Plagiobrissus grandis*, and this fact indicates that *loveni* is not really a Plagiobrissus. But until more and better material of its near allies is available, it may as well remain where it is.

In well-preserved material, particularly in large specimens, it is noticeable that besides the conspicuous notch in the ambitus at the front of the test, due to depression of ambulacrum III, there is a less marked notch in interambulacrum 5 due to a shallow, vertical furrow at the rear end. At the upper end of this furrow lies the large periproct; in a specimen 63 mm. long this is 11 mm. high and 8 mm. wide. Below the periproct the test is more or less vertical; there is no such slope towards the mouth as marks the test of *P. grandis*. The peristome is quite anterior in position with a conspicuous labium in good material; usually the labium is more or less crushed flat or broken away; in a specimen 100 mm. long, it is 10 mm. wide, 5 mm. long, and projects about 3 mm. below the adjoining surface of the test; its tip is 30 mm. from the extreme anterior margin of the test.

Compared with *P. grandis, loveni* differs in the deeper depression of ambulacrum III, in the much greater divergence of petals II and IV, and in the curvature of those petals; in *grandis*, they curve forward and then outward while in *loveni* they curve outward, and forward only at tip. There is very great individual diversity in *loveni* in the degree to which the petals are depressed; in some cases they are scarcely depressed at all, while in other cases the depression is conspicuous; to a certain extent, weathering affects the appearance in this particular, badly weathered specimens having the petals apparently less depressed. There is not much diversity in the form and proportion of the petals, though the length of the posterior pair shows considerable variety and their width ranges from one fifth to more than one fourth of the length. The poriferous zones are always broad, each one exceeding the interporiferous area. The tuberculation of the test is notable, and is well shown in the photographs given; naturally it is profoundly affected by the amount of weathering but otherwise it shows little diversity. The peripetalous fasciole can be seen in more or less extended fragments in the better-preserved specimens but it is seldom that its entire course can be followed completely. In many specimens it cannot be discovered at all.

Plagiobrissus perplexus[1] H. L. Clark, sp. nov.

Plate 20, fig. 6. Plate 21, fig. 1, 2.

Holotype.— Coll. B. W. A. 138. M. C. Z. 3,310. West bank of the Yallahs River, St. Thomas Parish.

Test 83.5 mm. long, 66 mm. wide and 44.5 mm. high; width is thus nearly .80 of length, while height is .53. Apical system a little depressed, 44 mm. from anterior end of test; surrounding interambulacra of nearly equal height, but 2

[1] perplexus = *puzzling*, in reference to our doubt as to its true relationships.

and 3 are highest, 5 being 1.5 mm. lower than they are. Ambulacrum III is more or less concealed in matrix; it may be a little depressed; at ambitus there is a notch 2 mm. deep. Paired petals only a little depressed and reaching nearly to ambitus, as in *abruptus;* they are 48–50 mm. long and 8–9 mm. wide; about one third is occupied by the interporiferous area. Specimen weathered and in poor condition.

Oral surface coarsely tuberculated; plastron rather elevated with a fairly-well-marked keel. Periproct just above ambitus, 15 mm. high and 12 mm. wide. Peristome more or less concealed but evidently about 25 mm. from anterior end.

This unique specimen was found in eroded material from very hard strata, on a hillside, west bank of the Yallahs River, St. Thomas, above the second bridge. Its poor condition makes its identification difficult but it seems clear that it cannot be referred to any of the species previously known from the West Indies nor to any species referred to Plagiobrissus.

Plagiobrissus robustus [1] H. L. Clark, sp. nov.

Plate 20, fig. 7. Plate 21, fig. 3, 4.

Holotype.— Coll. B. W. A. 139. M. C. Z. 3,311. Near Johns Hall, Springfield road, St. James Parish.

Test 84 mm. long, 69 mm. wide and 38.5 mm. high; width is thus over .82 of length while height is .45. Test broadly rounded in front, narrowed and truncate behind. Apical system 33 mm. from anterior end, with 4 genital pores visible. Large tubercles within peripetalous fasciole, smaller and more numerous than in *loveni.* Ambulacrum III very slightly depressed, not petaloid, with scarcely a notch at ambitus. Petals, especially posterior pair, much longer than in *loveni;* I and V about 50 mm. long by 7 mm. wide; II and IV very widely divergent, 35 x 7 mm.; both pairs of petals reach to within about 5 mm. of ambitus.

Periproct 11 mm. high, 9 mm. wide, occupying most of rear end of test, which is scarcely at all depressed by a vertical furrow as it is in *loveni.* Oral surface more rounded and less flattened than in *loveni;* peristome about 25 mm. from its anterior end; ambulacra around peristome rather deeply depressed for 15–20 mm., much more so than in *loveni.*

While this species shows resemblances to both *loveni* and *abruptus,* it is easily distinguished by the position of the apical system, the proportions of the petals and the characters of the oral surface. Besides the holotype there are four paratypes, all in poor condition; they range from 80 x 63 x 38 mm. to 90 x 55 x 37 mm. They add nothing to our knowledge of the species.

[1] robustus = *stout,* in reference to the general appearance.

DESCRIPTIONS OF NEW SPECIES OF CAINOZOIC ECHINOIDEA FROM JAMAICA.

By Herbert L. Hawkins.

Dr. C. A. Matley has entrusted to me for examination a collection of Jamaican fossil Echinoidea and I wish to express my thanks to him for enabling me to study a series of interesting forms which makes a notable addition to the known fauna of the island. Some idea of the increase in our knowledge of Jamaican Tertiary echinoids can be derived from statistics. In 1922, when Jackson published his monograph on the fossil Echini of the West Indies, there were recorded only four named species from the Cainozoic rocks of the island. In the short space of three years, Dr. C. T. Trechmann and Dr. Matley have, according to my results, brought that number up to twenty-five. In addition to determinable forms, there are battered representatives of a large number of (chiefly spatangid) species which await collection of more perfect material to be added to the list.

Dr. Matley's new collection comprises some 130 specimens, but the number capable of precise diagnosis is much less. Most of the material is either sadly abraded by the weather, or else embedded in tough crystalline limestone that can only be removed by scraping, a worse disaster than weathering.

The entire absence of Regular Echinoidea is a striking feature of this collection. There is not so much as a radiole to represent that group; the only specimen that was provisionally labeled "Cidaris" in the field proves to be an obscure fragment of some sponge-like organism. Indeed, out of the twenty-five named species of Jamaican Tertiary echinoids, two only (known each from a solitary example) are Regular forms, and a single Cidaris plate is the only representative of the subclass in undetermined material. The scarcity of Regular echinoids seems to be a world-wide feature of Lower Cainozoic faunas; but the Jamaican disproportion is somewhat extreme.

Fibularia jacksoni, sp. nov.

Plate 22, fig. 1–3.

Holotype.— Coll. Brit. mus. E. 17,665. Yellow limestone (Eocene). J 215 M. Main road, northeast of Albert Town, Upper Trelawney.

Dimensions.[1]

Specimen	A[2]	B	C	D	E
Length	8.0 (1)	8.2 (1)	7.2 (1)	7.0 (1)	7.0 (1)
Breadth	7.0 (.87)	7.2 (.88)	6.1 (.85)	6.2 (.88)	6.0 (.86)
Height	6.0 (.75)	6.5 (.79)	4.5 (.63)	4.4 (.63)	5.3 (.76)
Between peristome and periproct	0.8 (.10)	0.8 (.09)	1.1 (.15)	1.0 (.14)	1.1 (.16)
Pores in petal III	13	13	11	12	11

[1] In millimetres; proportions in parentheses.

[2] Holotype; in addition to the holotype there are twelve other specimens.

The test is small and ovate, narrowed anteriorly, broadest across petals II and IV, and scarcely narrowing backwards to petals I and V, thence abruptly truncated. The adapical surface comes to a blunt point at the apical system, and shows a gentle, but progressively increasing, slope outwards to the ends of the petals, when it drops sharply to form almost vertical sides. The adoral surface is comparable, the peristome corresponding to the apical system, but the anterior region is inflated.

The peristome is small (about 0.5 mm. across), obscurely subpentagonal, and surrounded by a faint excrescence of the test, with the five proximal ambulacral pores on its inner declivity.

The periproct is minute, almost round, with a slightly thickened margin that merges anteriorly into that of the peristome, forming a narrow bar separating the two apertures.

The apical system forms a compact, minute button at the apex, and shows four genital pores arranged in a trapezium with the anterior pair approximated and slightly larger than the others.

The petals are well differentiated, with divergent pore-pairs set very obliquely, separated by a feebly inflated perradial tract.

Most of the periphery consists of ambulacral plates, those areas being at least three times wider than the interambulacra at the ambitus. Traces of the typical strings of minute pores are visible on the extrapetaloid plates. The whole surface is covered with very uniform small tubercles set in such deep areolae that their mamelons hardly project above the general level of the test. (Described from the holotype).

Dissection of specimen B showed that there are no internal buttresses.

Specimens C, D and E are more elliptical than ovate, but that difference, coupled with their less height and the greater separation of the peristome and periproct, seems to imply immaturity.

The genus Fibularia has not been recorded previously from the West Indies; but there seems to be at least one species, *Echinocyamus texanus* Twitchell, in the Eocene of Texas. That species agrees with *F. jacksoni* in the development of the petals; and, being much smaller than the smallest of the Jamaican specimens, may possibly be an immature stage of the latter. Since, however, only one specimen of *F. texana* is known it would be unsafe to unite the two species, for their actual differences are considerable. *Fibularia* (*Echinocyamus*) *vaughani* Twitchell, from the Lower Oligocene of Georgia, is quite distinct in its relative length and in the depression of its peristomial region.

I have great pleasure in associating with this species, which adds a new genus to the Antillean fauna, the name of Dr. R. T. Jackson.

Sismondia crustula, sp. nov.

Plate 22, fig. 4, 5.

Cotype A.— Coll. Brit. mus. E. 17,667. Yellow limestone (Eocene). "Small echinoid bed," J. 1,501 M. Peace River road, less than a mile from Peace River.[1]

Cotype B.— Coll. Brit. mus. E. 17,668. Yellow limestone (Eocene). "Small echinoid bed." J. 1,503 M. Peace River road, about one and one half miles from head.

Dimensions.

Specimen	A[2]	B	C
Length	18.5 (1)	18.0 (1)	16.0 (1)
Breadth	16.8 (.9)	16.8 (.9)	14.2 (.9)
Height	3.0 (.16)	3.1 (.17)	2.5 (.16)
From peristome to periproct	6.7 (.36)	6.5 (.35)	5.4 (.34)
From periproct to posterior margin	1.5 (.08)	1.5 (.08)	1.2 (.07)
Length of petal III	?4.8 (.26)	4.6 (.25)	4.2 (.26)
Pores in column of petal III	?	29	28

The test is small, ovate and slightly subangular. The adapical surface is much flattened, rising to a feeble apex at the apical system, and raised slightly towards the ambitus, producing a shallow concavity encircling the test around the ends of the petals. The ambitus is fairly sharp; the adoral surface practically flat, faintly concave. The peristome is minute, virtually midway between front and back, sometimes slightly anterior to the midpoint. The periproct is also minute, situated very near to the posterior margin, slightly wider than long, and surrounded by a feebly raised rim.

The apical system is almost central, and very large in proportion, so that the petals do not appear to meet at the apex. It is tuberculate and granulate like the rest of the test, and shows four genital pores. In some specimens the system is distinctly raised above its surroundings.

The ambulacral petals extend over more than three quarters of the distance from the apex to the margin. They are scarcely inflated. The poriferous zones are wide, retaining their width and distance from one another for the greater part of their length. Just towards the distal ends of the petals the poriferous zones swing inward and appear to coalesce, forming perfectly-closed petals. The outer pores are long slits, and the inner minute round holes, the members of a pair being connected by a groove following the suture, and separated from the next pairs in series by a ridge (in the case of the outer pore) and granules (the inner pore). Minute pores are scattered promiscuously over the remaining ambulacral

[1] It has seemed advisable to select cotypes, as none of the specimens show both surfaces perfectly. There are thirty-three other specimens from the same bed at these and an intervening locality, and another series is labeled "Road at Church, South of Christiana."

[2] Cotypes.

plates, and very thickly on the narrow proximal plates; they seem not to occur on the interambulacrals.

The whole surface of the test is studded with deep-set tubercles of even size, large in proportion, and the intervening spaces are evenly and completely granulate.

This little echinoid is very near to *S. antillarum* Cotteau, a very rare form from the Eocene of St. Bartholomew. It is, indeed, quite possible that the only known complete specimen of Cotteau's species may be a mere variant from the Jamaican type; but among the twenty-five specimens of *S. crustula* suitable for measurement there are none so nearly circular as *S. antillarum*. Since the largest example of *S. crustula* is nearly 24 mm. in length, and the smallest about 9 mm., and the proportions remain almost identical throughout the series, it would appear that its shape is a constant feature, and that it does not allow of such roundness as that characteristic of *S. antillarum*. All of the Jamaican specimens are also much flatter than Cotteau's example. Further, the petals are much longer in *S. crustula*, and the concavity at their extremities involves the interambulacra as well, instead of forming pockets as in *S. antillarum*. Again, the periproct is nearer the margin in *S. crustula*, and relatively more minute.

I have given this species the name *crustula* to indicate its close resemblance to *S. crustuloides* (Morton *sub* Scutella) from the Eocene of the United States. *Simondia crustuloides* is much thicker than *S. crustula*, and its petals are more pointed distally and less parallel-sided than in the Jamaican form, while its peristome is definitely anterior to the center. But the shape of the test, both in outline and in the adapical and adoral concavities, and the relative sizes of the peristome and periproct, are strikingly alike in the two forms. *Simondia crustuloides* is ascribed to the Upper Eocene and doubtfully to the Lower Oligocene; the genus is considered by Lambert to be restricted to the Eocene.

Rhynchopygus matleyi, sp. nov.

Plate 22, fig. 6–8.

Holotype.— Coll. Brit. mus. E. 17,666. Yellow limestone (Eocene). J. 201 M. Watercourse near Spring Mount, St. James.

Dimensions.

Length	22.5 (1)
Breadth	19.0 (.84)
Height	11.25 (.5)
From peristome to anterior margin	9.0
From peristome to posterior margin	12.0
Length of petal III	10
Pores in a column of petal III	41

The adapical surface is domed, with the highest point a little in front of the apical system. The adoral surface is distinctly concave. The ambitus is sharp, rounded anteriorly, with subparallel sides diverging very slightly to the widest point near the distal ends of the posterolateral petals, thence forming an almost semicircular curve for the posterior margin. There is a very faint indentation of the margin below the periproct.

The apical system is about 1 mm. in diameter, with four large genital pores and a central madreporite.

The peristome is small, and deeply sunken within a well-developed floscelle.

The periproct is almost circular, and situated on an almost vertical part of the posterior margin, about 2.5 mm. above the actual ambitus. The apicad overhang of the interambulacrum seems slight, but this may be due to attrition.

The five petals are essentially similar, but those of areas I, III, and V are longer and narrower than the others. All are lanceolate but unclosed, and the pores of a pair are separated by a distance little less than the width of the perradial tract. In petals I and V the poriferous zones bordering interambulacrum 5 are distinctly narrower than those of the adjacent columns. The phyllodes are widely expanded and deeply sunken.

The entire adapical surface seems to have been covered with fine, close-set tuberculation. Adorally the tubercles are much larger and more widely spaced. On the adoral surface area 5 is subcarinate, forming a low, broad ridge across the concavity of the surface. The peristomial bourrelets are exceedingly prominent except for that of area 5, which is narrow and relatively feeble.

It is not without some hesitation that I place this species in Rhynchopygus. Were it not for the indications of an "eave" overhanging the periproct it would be reasonable to place it in Cassidulus *s. str.* It is unfortunate that all of the five specimens are water-worn, so that this distinctive prominence, assuming that it existed, has been bruised off. But in view of the close comparability between this species and *R. lyelli* Conrad (*fide* Clark and Twitchell), I am inclined to trust the appearance of the critical region, which is certainly suggestive of previous existence of a "beak." *Rhynchopygus matleyi* may be distinguished from *R. lyelli* by two features. In Conrad's species the periproct is much farther from the ambitus, and the highest point of the test is posterior to the apical system. Otherwise the two types seem nearly alike.

Save for a specifically indeterminable couple of specimens recorded by me in 1924, this is the first indication of Rhynchopygus as a member of the West Indian Tertiary fauna.

EUPATAGUS HILDAE, sp. nov.[1]

Plate 22, fig. 9, 10. Figure 1.

HOLOTYPE.— Coll. Brit. mus. E. 17,664. White limestone (? Oligocene). J. 78 M. St. Hilda's School, Brown's Town.

Dimensions.

Length	105 (1)
Breadth	81 (.77)
Height	63 (.60)
From peristome to anterior margin	26 (.25)

The test is ovate in outline with a narrow and shallow anterior notch. The adapical surface is greatly inflated, so that the sides are almost vertical; it is obtusely carinate in area 5. The adoral surface is nearly flat, scarcely concave even at the peristome. The ambitus is well rounded.

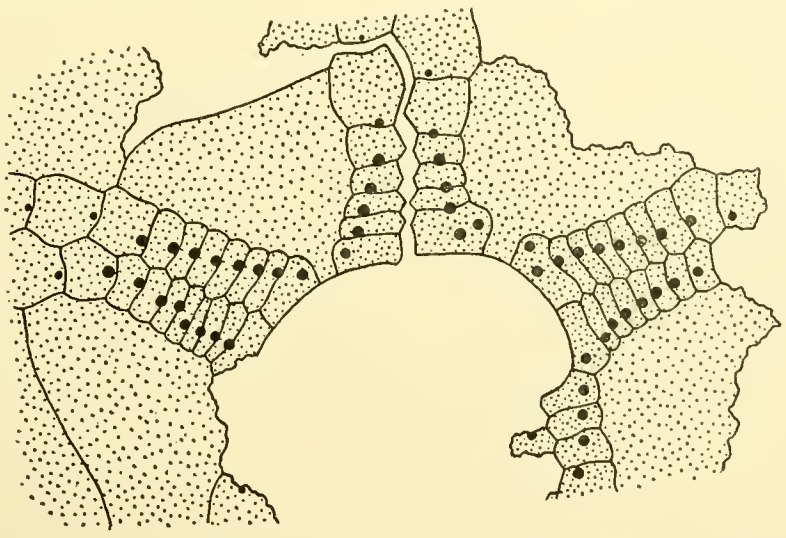


Fig. 1. *Eupatagus hildae* Hawkins. Enlargement of pseudophyllode. Note exclusion of area 4 (and presumably of area 1) from the peristome. The unshaded areas are missing from the specimen.

The apical system is relatively minute. The madreporic plate passes right through the system, and the genital pores are very large.

The peristome (Figure 1) is incomplete posteriorly, but was evidently lunate in outline. It is about 16 mm. across. Areas 1 and 4 are excluded from its margin by the meeting of the lateral ambulacra. The periproct is destroyed.

The ambulacra (areas I, II, IV and V) are largely petaloid, the petals extending from the apex almost to the ambitus. Except for the first four or five pairs

[1] As Jackson has remarked (1922; p. 88) the species of fossil Spatangidae from the West Indies usually referred to *Eupatagus* are notably different from the living genotype. It will probably prove necessary to diagnose a new genus for them.

from the apex the pores are large, round and conjugate, enclosing very wide interporiferous areas. Petals II and IV are faintly arcuate near the apex, the posterior pair are almost straight. Most of area III is missing from the adapical surface, but it was evidently very narrow and flush near the apex, becoming very slightly wider and feebly sulcate towards the margin. Adorally the ambulacra form a conspicuous pseudophyllode around the peristome.

The interambulacra (like the ambulacra) are covered with fairly close-set rather small tubercles of irregular size on the adapical surface. No ornament is preserved adorally, and no fascioles can be detected.

In spite of its incomplete preservation, this splendid Eupatagus seems worthy of description. Weathering has removed all the exposed parts of the adoral surface, and most of the ornament from the rest of the test.

Undoubtedly the nearest ally of this species is *E. grandiflorus* (Cotteau). This Eocene species, known only from the holotype from St. Bartholomew, is, however, much smaller, and the petaloid pores are relatively more widely separated. The arcuation of the anterolateral petals is much stronger in Cotteau's species; indeed, the aspect of the petals recalls Clypeaster; and the proportions of the test differ. In *E. grandiflorus*, the length (say 78 mm.) being taken as 1, the breadth is 0.82 and the height 0.54 as against the figures given for *E. hildae*.

Coming from the White Limestone, *E. hildae* is presumably of Oligocene age; but it seems to agree so closely with Eupatagus species A of Jackson (1922, p. 90), which he regards as occurring with *Oligopygus ovumserpentis* (and therefore Eocene), that some reservation must be made. However, Jackson's account of his Jamaican species A would not apply wholly to *E. hildae*, as he states that the poriferous and interporiferous areas are of about the same width; and he also refers to scattered large tubercles, of which no traces can be seen in *E. hildae*. So that there is no serious ground for questioning either the accuracy of the label or the correctness of the correlation.

Plagiobrissus loveni (Cotteau).[1]

Plate 22, fig. 11–13. Figure 2, 3.

From near base of Yellow limestone (Eocene); Ginger Valley, St. James, near Trelawney boundary, Jamaica (locality J 213 M). (Brit. Mus. E 17,663). Three other specimens from the same locality and horizon. There are two specimens from locality J 212 M (near Somerton, St. James) that appear to belong to the same species.

[1] Professor Hawkins's manuscript included a detailed description and figures of what he considered a new species of Macropneustes. As stated on p. 73, however, this echinoid has already been described as *Plagiobrissus loveni*. As Hawkins's careful description and figures throw additional light on this important species, they are given herewith.— H.L.C.

Dimensions.

Length	85.0 (1)
Breadth	75.5 (.88)
Height	35.0 (.41)
From peristome to anterior margin	16.0 (.2)
Width of periproct	14
Greatest width of petals	7.5

The test is cordiform, contracted anteriorly. The adapical surface is inflated, especially interradially. The adoral surface is almost flat, with a feeble plastronal carina and faint concavity towards the peristome. The ambitus is fairly sharp, with a shallow but definite anterior notch.

The peristome is roughly semicircular, and has a prominent labrum. The periproct is on a posterior face, directed downward. It is extremely large, with the greatest width near the apicad end. The apical system is very slightly excentric anteriorly.

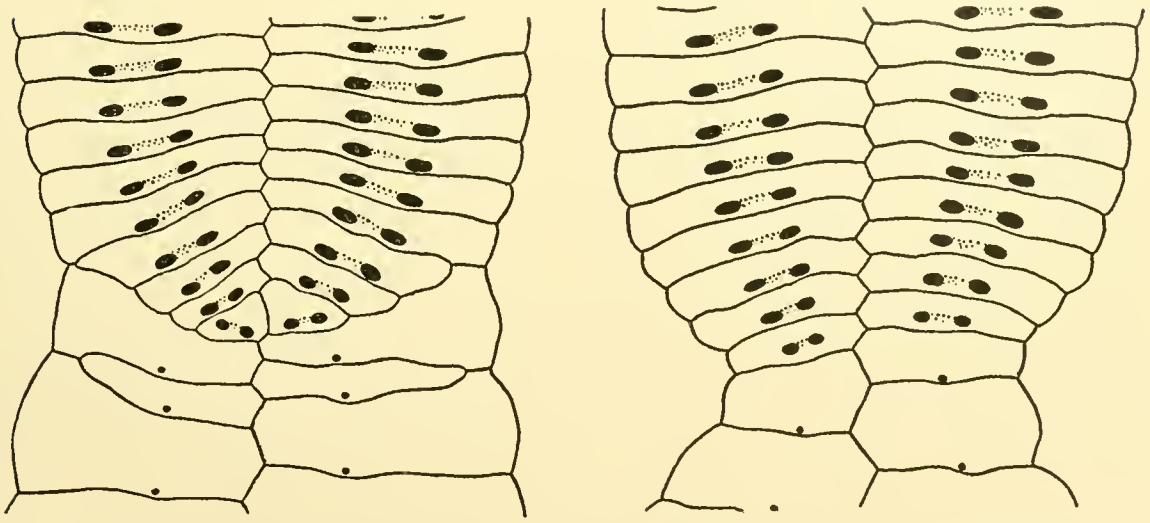


Fig. 2, 3. *Plagiobrissus loveni* (Cotteau). Enlarged plans of the distal parts of petals I and II, showing their dissimilarity. This character is normal for Eupatagus and Agassizia, and probably for Plagiobrissus as well. Note the great width of the adradial tract.

Ambulacrum III is narrow and flush adapically, gradually widening and sinking into a sulcus as it passes forward. The petals of the four other areas extend almost to the margin, and occupy shallow grooves which are caused more by the inflation of the interambulacra than by intrinsic excavation. The pores of a pair are almost alike. Each petal may be considered as divided into six bands of equal width, — the two adaradiad parts, the two poriferous zones, and the (double) interporiferous tract. Hence the ambulacra are considerably wider than the petals seem. Petals I and V are closed distally, while petals II and IV are open but somewhat contracted there (Figures 2, 3).

The interambulacra are wide, and areas 1, 4 and 5 are very tumid adapically. The large tubercles are numerous, arranged in transverse rows on the plates. Near the ambitus there may be as many as eight on a plate; they are larger and less abundant near the apex. Adorally the tubercles are smaller than those of the adapical surface; they are closely packed over the interambulacra (the ambulacra are practically bare); and the plastron is nodulose and rather finely tuberculate.

The peripetalous fasciole can be seen here and there. It is a very narrow band, and seems to follow the line of the ambitus and almost to coincide with it. Traces of a large, but narrow, subanal fasciole appear on the plastron.

EXPLANATION OF PLATES.

Except where otherwise indicated all figures are natural size.

In the case of all of the species described as new, the specimen figured is the holotype, unless otherwise designated.

PLATE 1.

PLATE 1.

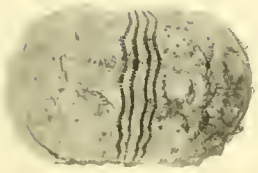
Fig. 1, 2. Cidaris loveni Cotteau.
Side views.

Fig. 3. Cidaris gymnozona H. L. Clark.
Aboral view.

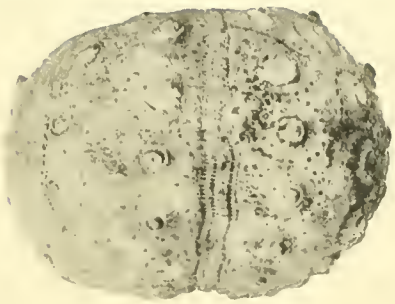
Fig. 4–6. Stenechinus perplexus H. L. Clark.
4. Aboral view.
5. Side view.
6. Oral view.

Fig. 7–9. Stenechinus regularis H. L. Clark.
7. Aboral view.
8. Side view.
9. Oral view.

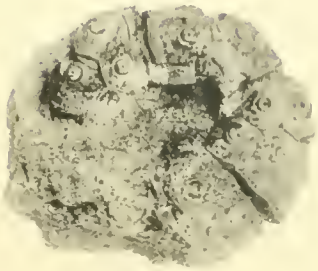
Fig. 10, 11. Triadechinus multiporus H. L. Clark.
10. Aboral view.
11. Side view.



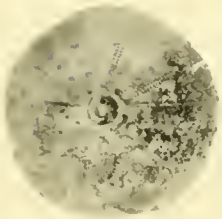
1



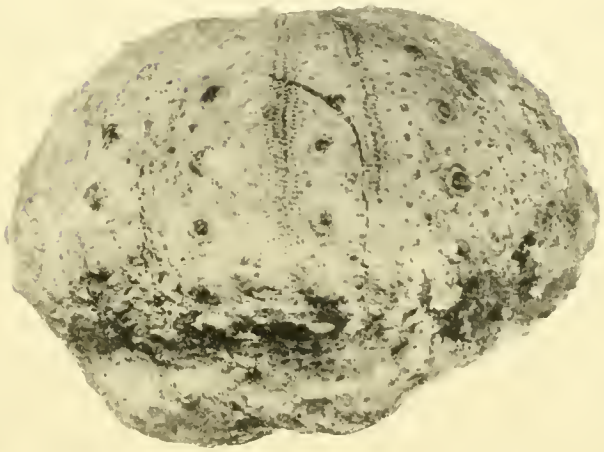
2



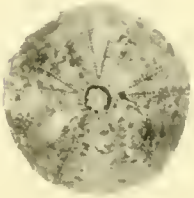
3



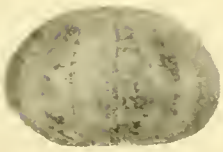
4



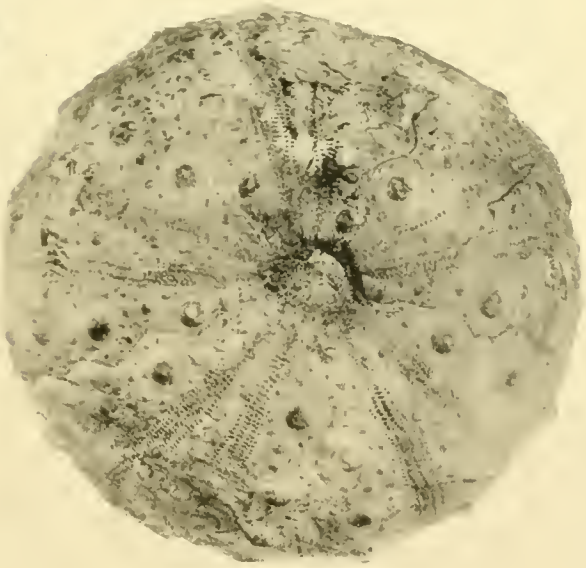
11



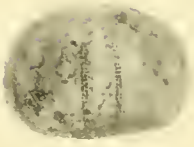
7



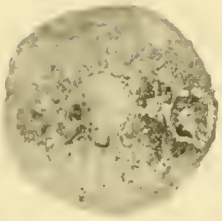
5



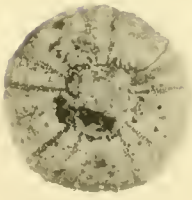
10



8



6



9

HELIOTYPE CO. BOSTON

PLATE 2.

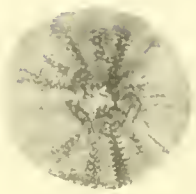
PLATE 2.

Fig. 1–3. Phymosoma peloria H. L. Clark.
1. Aboral view.
2. Side view.
3. Oral view.

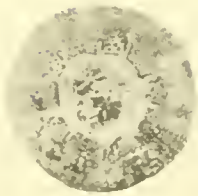
Fig. 4–6. Leiosoma chondra H. L. Clark.
4. Aboral view.
5. Side view.
6. Oral view.

Fig. 7, 8. Scoliechinus axiologus H. L. Clark.
7. Aboral view.
8. Oral view.

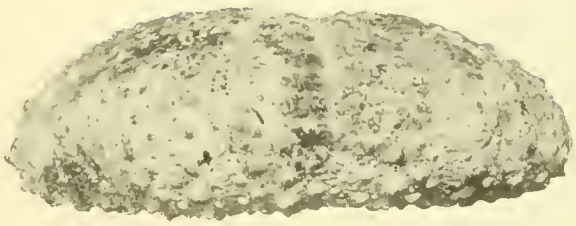
1



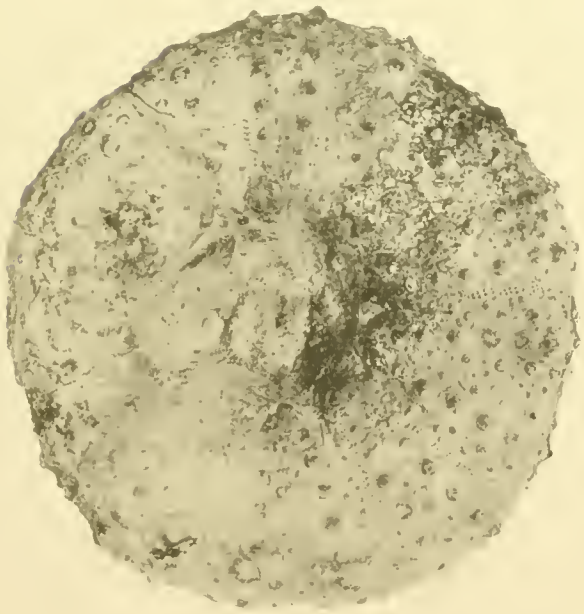
7



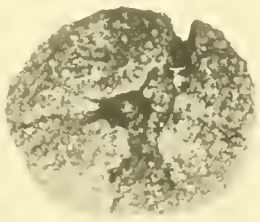
8



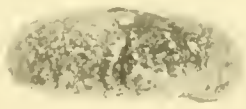
2



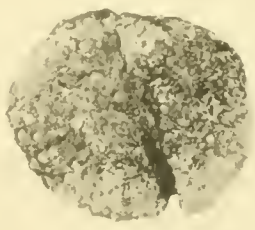
3



4



5



6

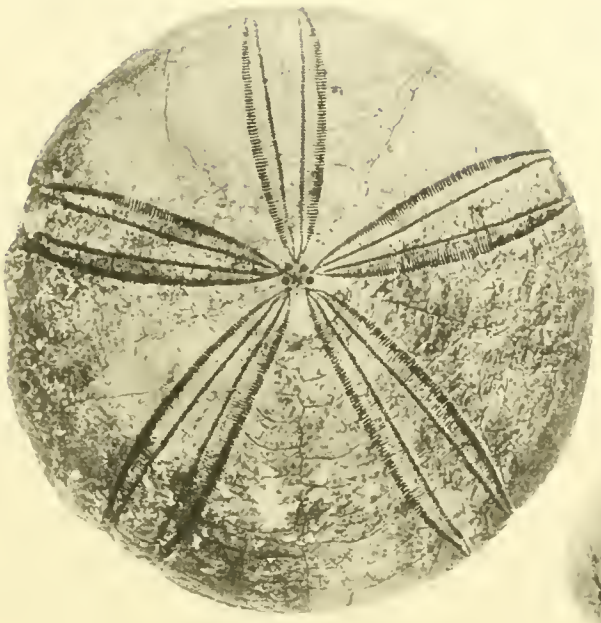
HELIOTYPE CO. BOSTON

PLATE 3.

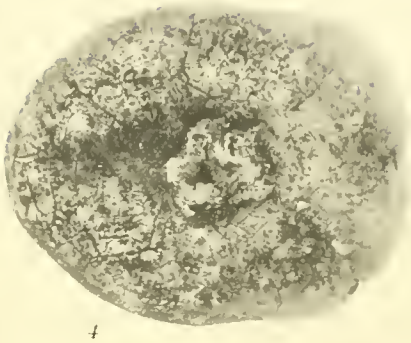
PLATE **3**.

Fig. 1–3. Amblypygus americanus Desor.
1. Oral view of a very large specimen.
2. Aboral view of smaller specimen.
3. Side view.

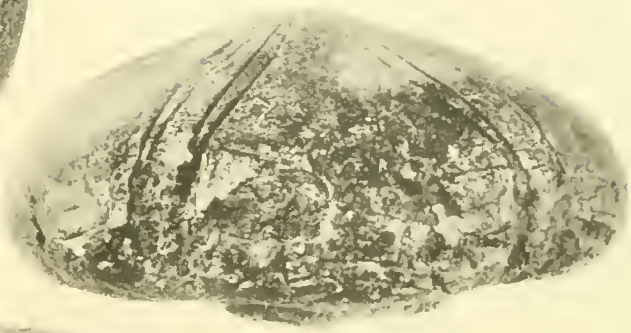
Fig. 4. Clypeaster antillarum Cotteau, juv. ?
Oral view.



2



4



3

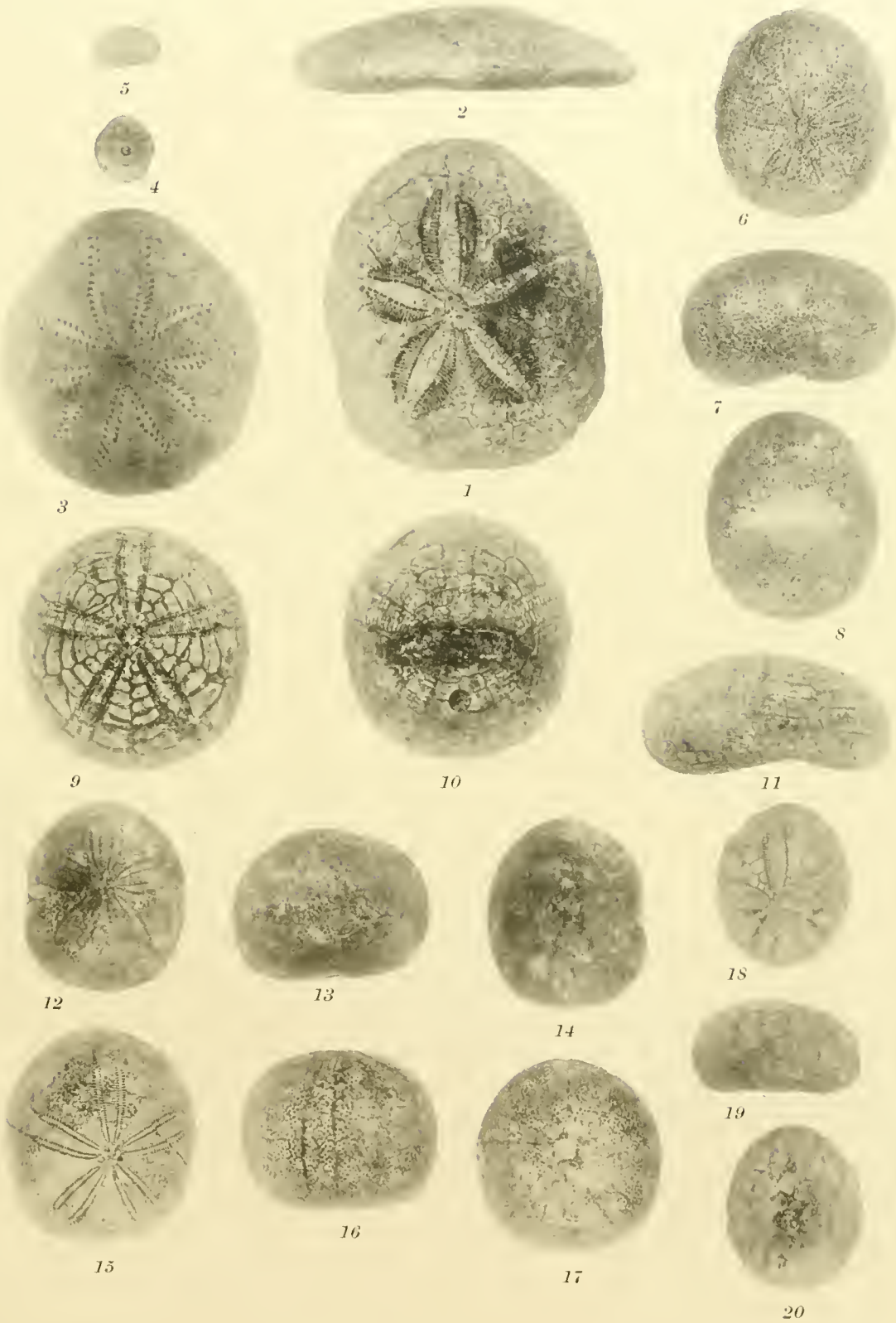
1

HELIOTYPE CO. BOSTON

PLATE 4.

PLATE 4.

Fig. 1, 2. Clypeaster antillarum Cotteau, juv. ?
1. Aboral view.
2. Left-side view.
Fig. 3–5. Fibularia jacksoni Hawkins.
3. Aboral view. × 5.
4. Oral view.
5. Left-side view.
Fig. 6–8. Oligopygus hypselus H. L. Clark.
6. Aboral view.
7. Right-side view.
8. Oral view.
Fig. 9–11. Oligopygus jamaicensis H. L. Clark.
9. Aboral view.
10. Oral view.
11. Left-side view.
Fig. 12–14. Pauropygus cylindricus H. L. Clark.
12. Aboral view.
13. Right-side view.
14. Oral view.
Figs. 15–17. Pauropygus altus H. L. Clark.
15. Aboral view.
16. Left-side view of another specimen.
17. Oral view.
Fig. 18–20. Pauropygus convexus H. L. Clark.
18. Aboral view.
19. Right-side view.
20. Oral view.



HELIOTYPE CO. BOSTON

PLATE 5

PLATE 5.

Fig. 1–3. Pauropygus elevatus H. L. Clark.
1. Aboral view.
2. Right-side view.
3. Oral view.

Fig. 4–6. Pauropygus latus H. L. Clark.
4. Aboral view.
5. Oral view.
6. Left-side view.

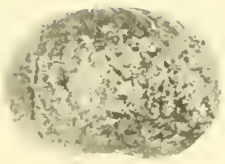
Fig. 7–12. Pauropygus ovumserpentis (Guppy).
7. Aboral view.
8. Left-side view.
9. Oral view of another specimen.
10. Left-side view.
11. Aboral view.
12. Aboral view of a 4-rayed specimen.

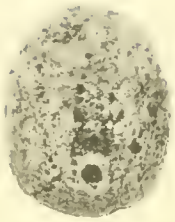
Fig. 13–15. Pauropygus parvipetalus H. L. Clark.
13. Aboral view.
14. Left-side view.
15. Oral view.

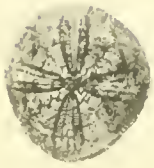
Fig. 16–18. Pauropygus platypetalus H. L. Clark.
16. Aboral view.
17. Oral view.
18. Left-side view.

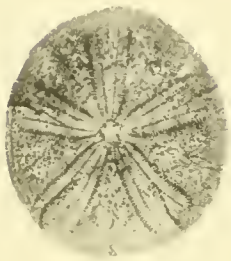
Fig. 19–21. Pauropygus pyramidoides H. L. Clark.
19. Aboral view.
20. Left-side view.
21. Oral view.

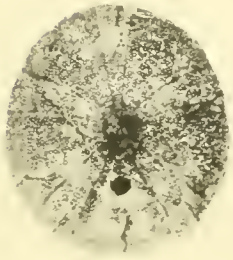
1


2

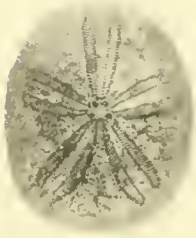

3

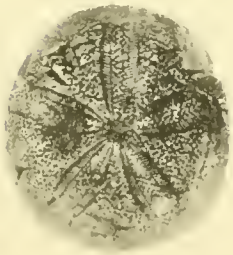

12

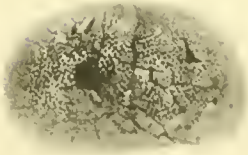

4

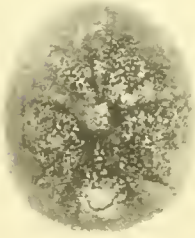

5

6

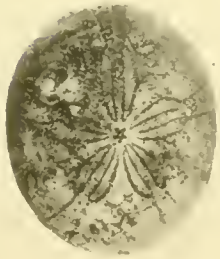

11

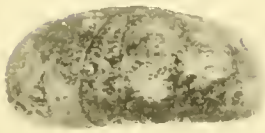

7

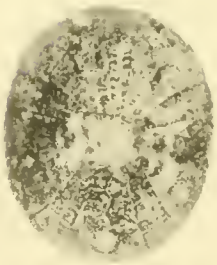

8

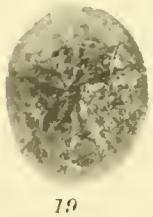

9

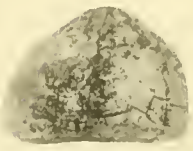
10


13


14


15

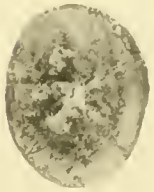

19


20

16

17

18


21

HELIOTYPE CO. BOSTON

PLATE 6.

PLATE 6.

Fig. 1–3. Pauropygus rotundus H. L. Clark.
1. Aboral view.
2. Left-side view.
3. Oral view.

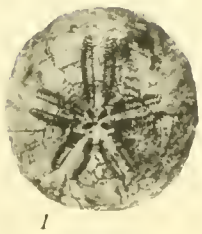
Fig. 4–6. Pauropygus rugosus H. L. Clark.
4. Aboral view.
5. Oral view.
6. Right-side view.

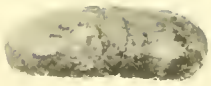
Fig. 7–9. Pauropygus stenopetalus H. L. Clark.
7. Aboral view.
8. Oral view.
9. Right-side view.

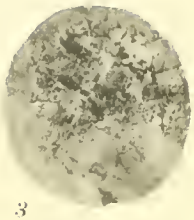
Fig. 10–12. Tarphypygus ellipticus H. L. Clark.
10. Aboral view.
11. Right-side view.
12. Oral view.

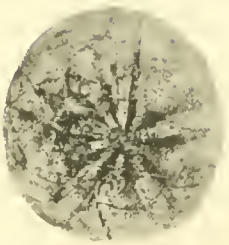
Fig. 13–15. Tarphypygus notabilis H. L. Clark.
13. Aboral view.
14. Left-side view.
15. Oral view.

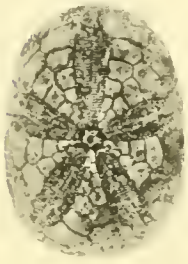
Fig. 16–20. Anisopetalus ellipticus H. L. Clark.
16. Aboral view.
17. Oral view.
18. Left-side view.
19. Posterior view.
20. Side view of a small specimen.


1


2

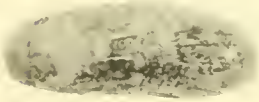

3

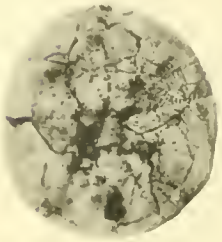

4


7

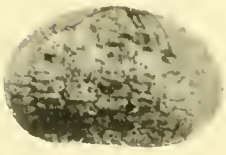
8

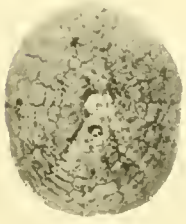
6

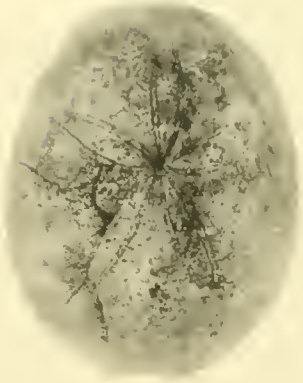

9

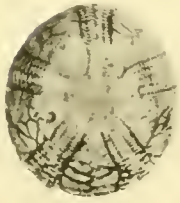

5

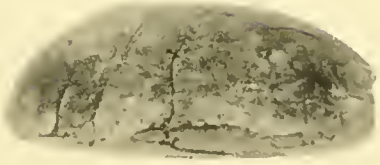
10

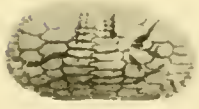

11

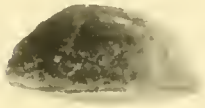

12

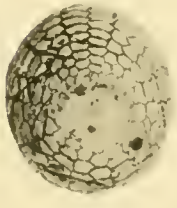

16


13

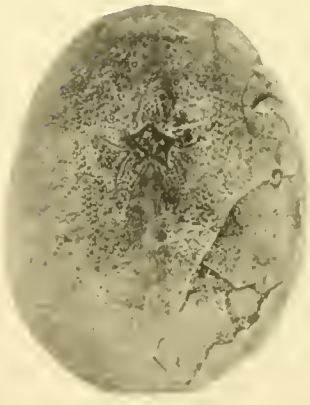

18


14


20


15

19


17

HELIOTYPE CO. BOSTON

PLATE 7.

PLATE 7.

Asterostoma excentricum (Lamarck).

Aboral view of very large specimen, somewhat depressed by pressure.

HELIOTYPE CO. BOSTON

PLATE 8.

PLATE 8.

Asterostoma excentricum (Lamarck).

Oral view of same specimen as shown on Plate 7.

HELIOTYPE CO. BOSTON

PLATE 9.

PLATE 9.

Fig. 1–4. Echinolampas altissima H. L. Clark.
1. Aboral view.
2. Oral view.
3. Left-side view.
4. Left-side view of a young paratype.

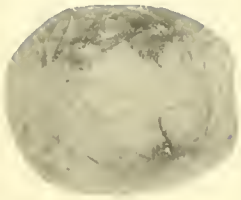
Fig. 5, 6. Echinolampas brachytona H. L. Clark.
5. Aboral view.
6. Left-side view.

Fig. 7, 8. Echinolampas clevei Cotteau.
7. Aboral view.
8. Right-side view.

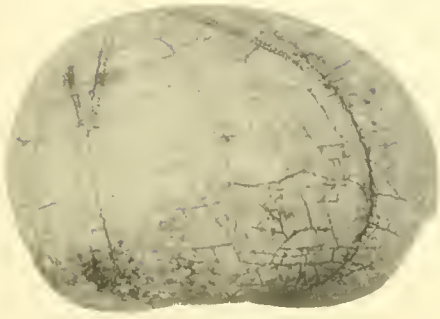
Fig. 9–13. Echinolampas paragoga H. L. Clark.
9. Aboral view.
10. Posterior view.
11. Aboral view of young paratype.
12. Oral view.
13. Left-side view.

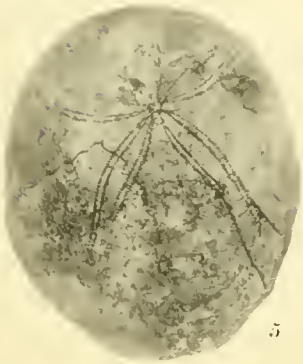
Fig. 14–17. Echinolampas strongyla H. L. Clark.
14. Aboral view.
15. Oral view.
16. Left-side view.
17. Aboral view of young paratype.

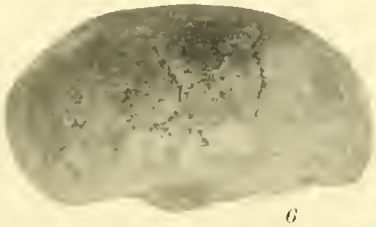
1


4

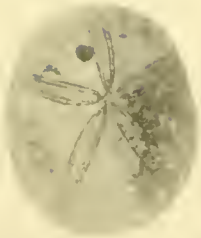
2

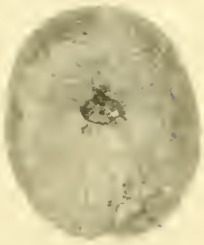

3

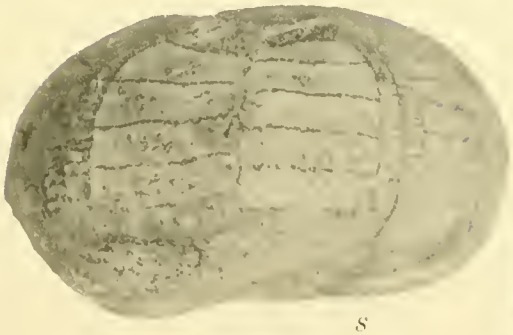

5

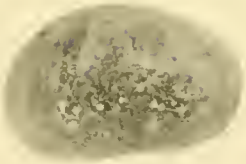

6

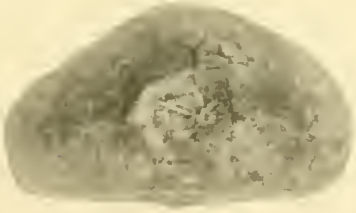
7

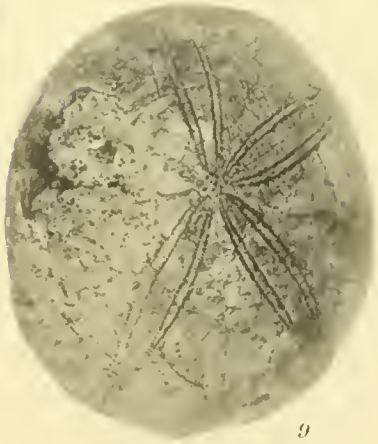

11


12

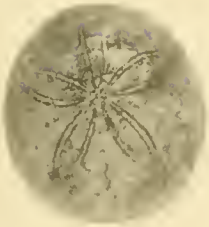

8

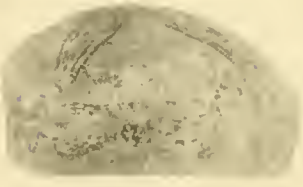

13


10


9

14


17


16

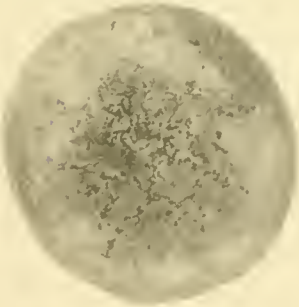

15

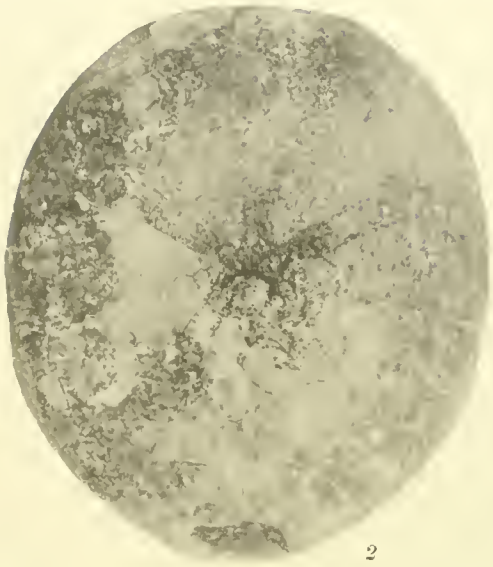
PLATE 10.

PLATE 10.

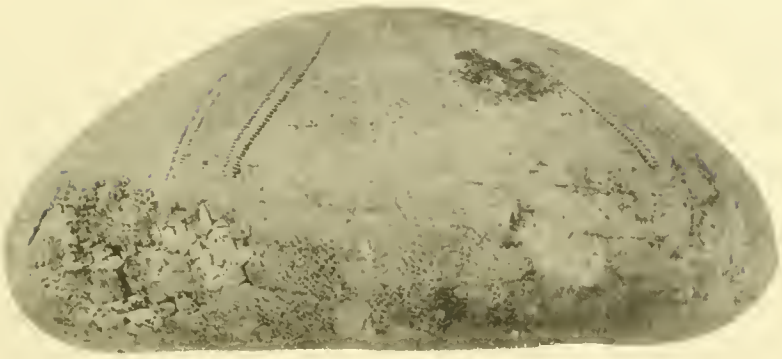
Fig. 1–3. Palaeolampas alta H. L. Clark.
1. Aboral view.
2. Oral view.
3. Left-side view.

Fig. 4–6. Palaeolampas plateia H. L. Clark.
4. Aboral view.
5. Oral view.
6. Left-side view.

1

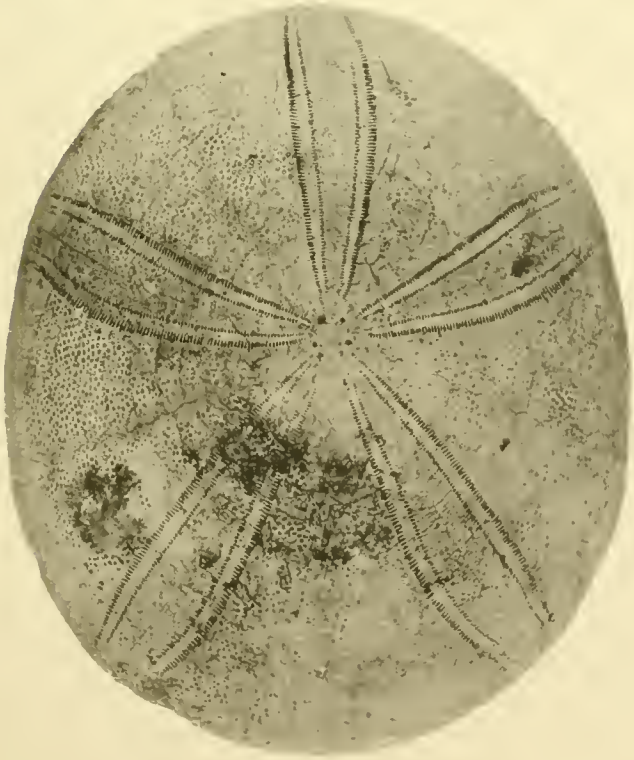


2

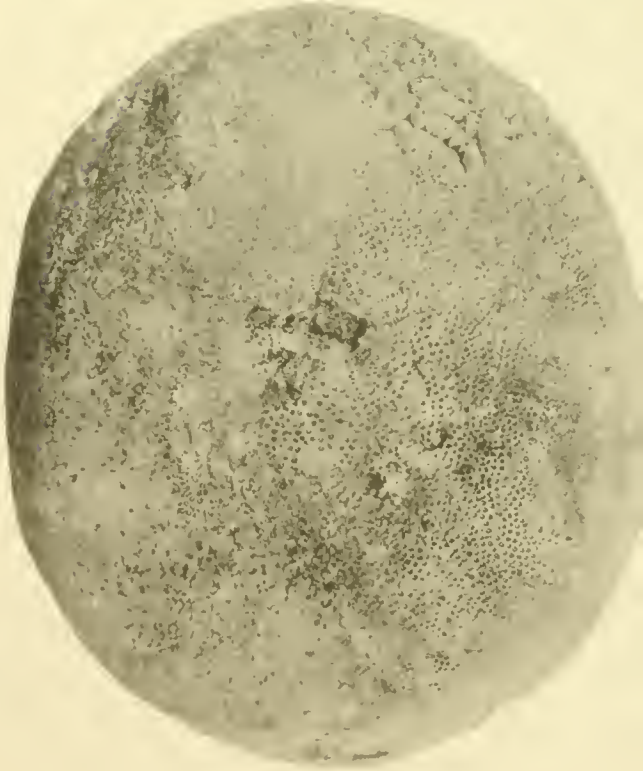


6

3



4



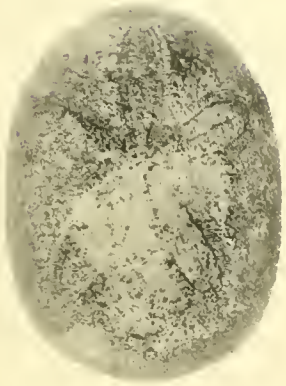
5

HELIOTYPE CO. BOSTON

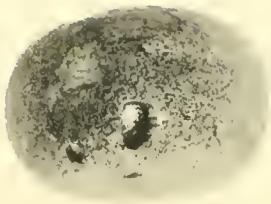
PLATE 11.

PLATE **11**.

Fig. 1, 2. Parapygus antillarum (Cotteau).
1. Aboral view.
2. Posterior view.
Fig. 3, 4. Rhynchopygus matleyi Hawkins.
3. Aboral view of narrow specimen.
4. Aboral view of wider specimen.
Fig. 5–7. Rhynchopygus punctatus H. L. Clark.
5. Aboral view.
6. Left-side view.
7. Oral view.
Fig. 8–10. Hypselaster perplexus H. L. Clark.
8. Aboral view.
9. Right-side view.
10. Oral view.
Fig. 11–13. Schizaster altissimus H. L. Clark.
11. Aboral view.
12. Oral view.
13. Right-side view.
Fig. 14–16. Schizaster brachypetalus H. L. Clark.
14. Aboral view.
15. Right-side view.
16. Oral view.

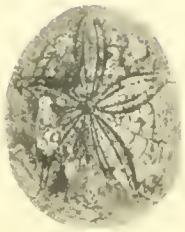


1



2

3

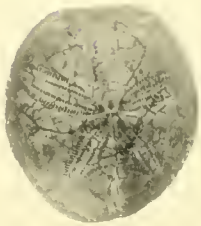


4

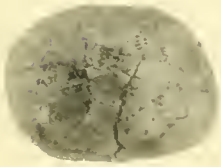
5

6

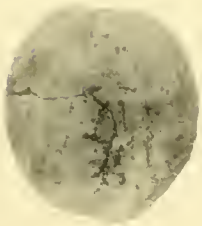
7



8

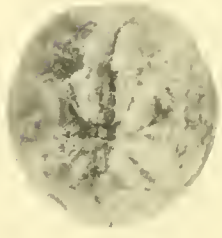


9

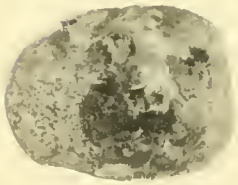


10

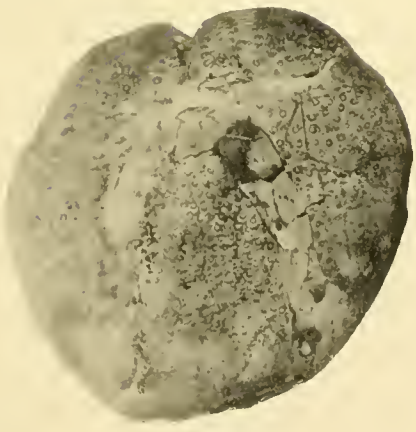
11



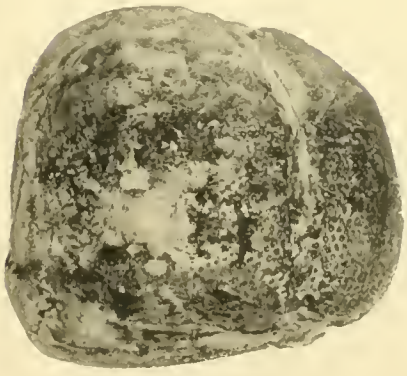
14



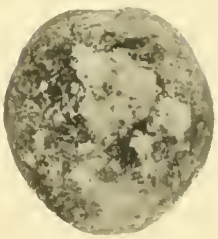
15



12



13



16

HELIOTYPE CO. BOSTON

PLATE 12.

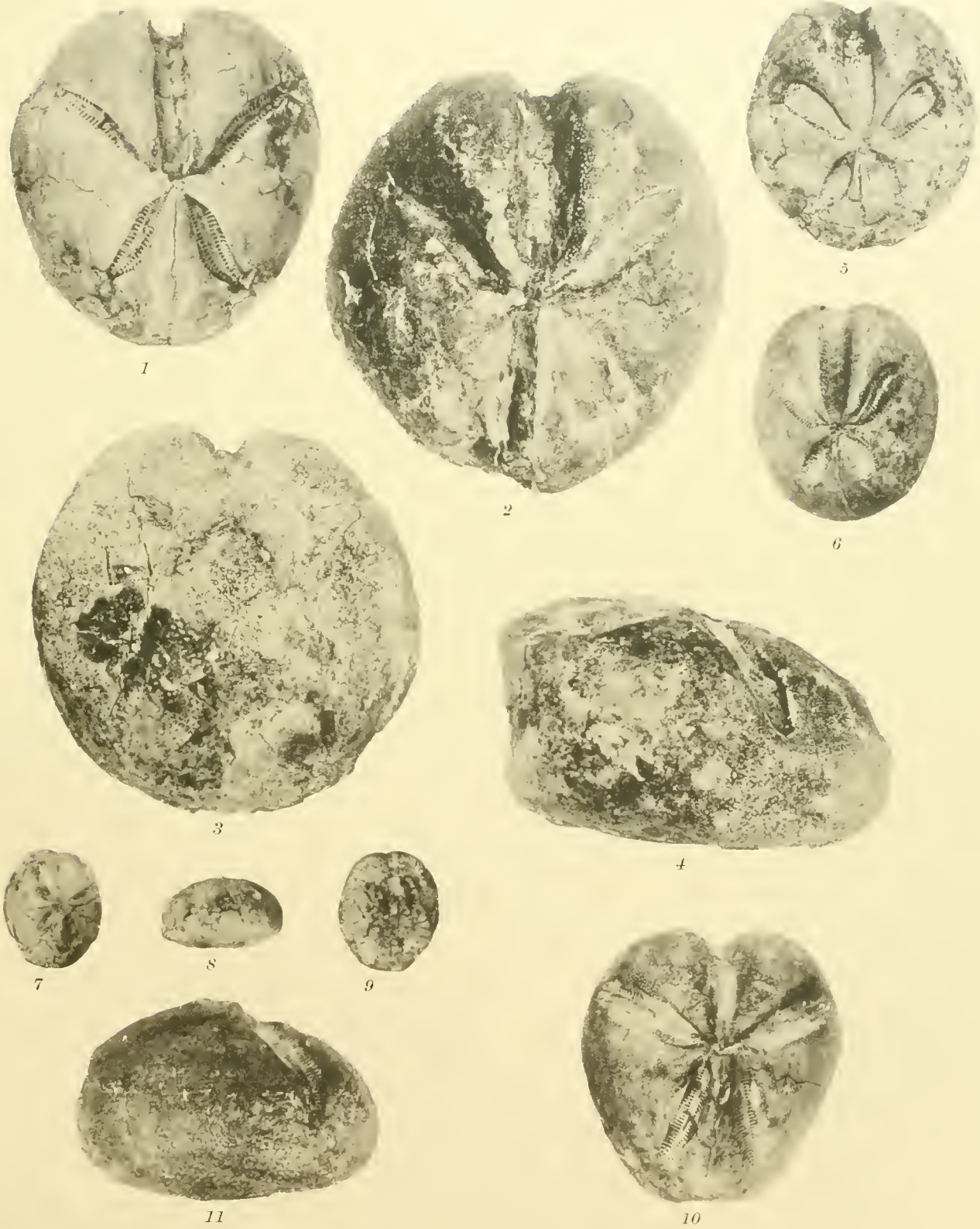
PLATE **12.**

Fig. 1–4. Schizaster bathypetalus H. L. Clark.
1. Aboral view.
2. Aboral view of a large specimen.
3. Oral view.
4. Right-side view.

Fig. 5, 6. Schizaster dumblei Israelsky.
5. Aboral view of a wide specimen.
6. Aboral view of a narrow specimen.

Fig. 7–9. Schizaster dyscritus H. L. Clark.
7. Aboral view.
8. Right-side view.
9. Oral view.

Fig. 10, 11. Schizaster hexagonalis H. L. Clark.
10. Aboral view.
11. Right-side view.



1

2

3

4

5

6

7

8

9

10

11

HELIOTYPE CO. BOSTON

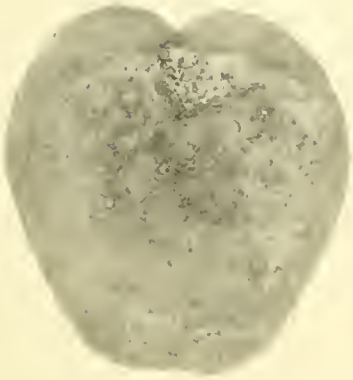
PLATE 13.

PLATE 13.

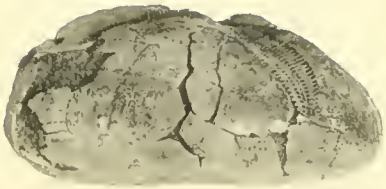
Fig. 1–3. Schizaster hexagonalis H. L. Clark.
1. Oral view.
2. Right-side view of a much-weathered paratype.
3. Aboral view.

Fig. 4–7. Eupatagus alatus H. L. Clark.
4. Aboral view.
5. Aboral view of small paratype.
6. Oral view.
7. Left-side view.

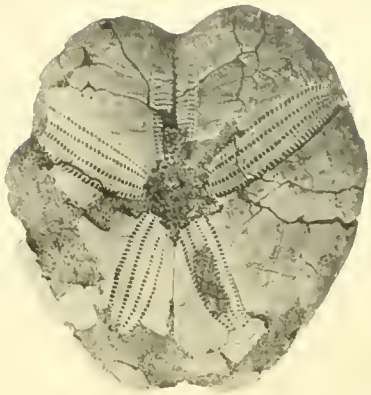
Fig. 8, 9. Eupatagus attenuatus H. L. Clark.
8. Aboral view.
9. Left-side view.



1



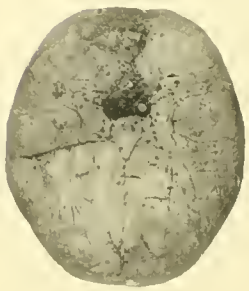
2



3

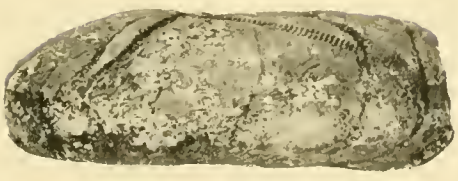
5

4

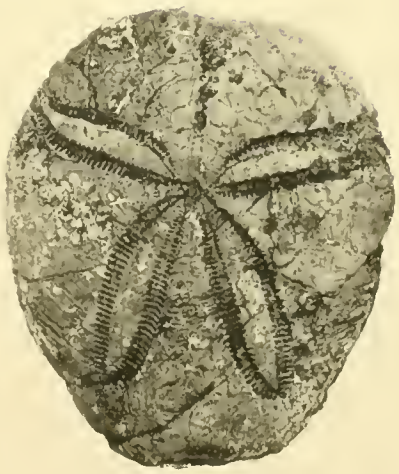


6

7



9



8

HELIOTYPE CO. BOSTON

PLATE **14.**

PLATE 14.

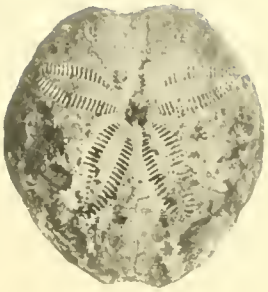
Fig. 1–3. Eupatagus defectus H. L. Clark.
1. Aboral view.
2. Oral view.
3. Left-side view.

Fig. 4–6. Eupatagus longipetalus H. L. Clark.
4. Aboral view.
5. Oral view.
6. Right-side view.

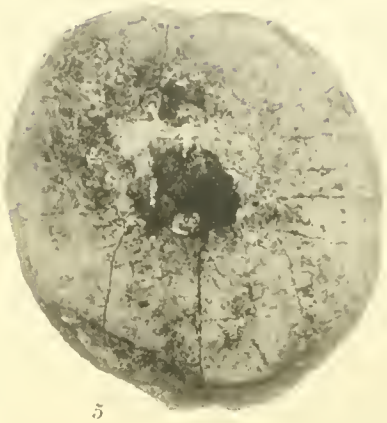
Fig. 7–9. Macropneustes altus H. L. Clark.
7. Aboral view.
8. Oral view.
9. Right-side view.

Fig. 10, 11. Macropneustes angustus H. L. Clark.
10. Left-side view of young paratype.
11. Aboral view.

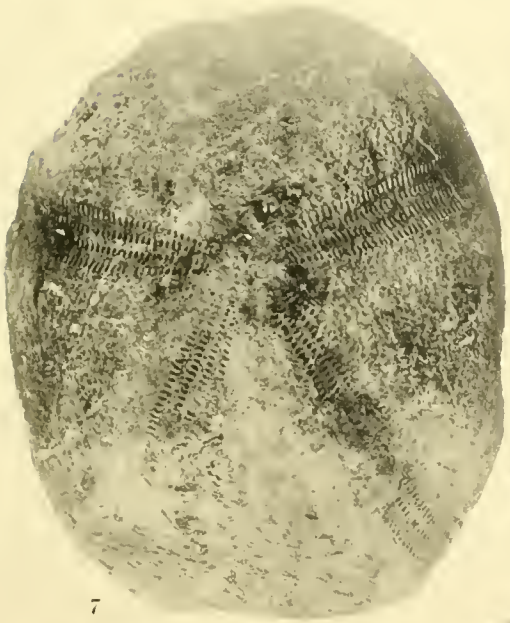
4



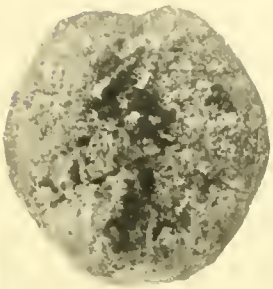
1



5

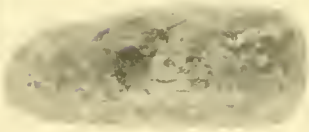


7

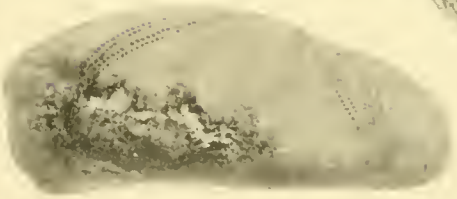


2

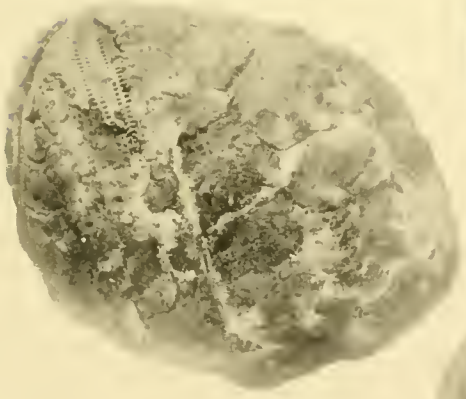
8



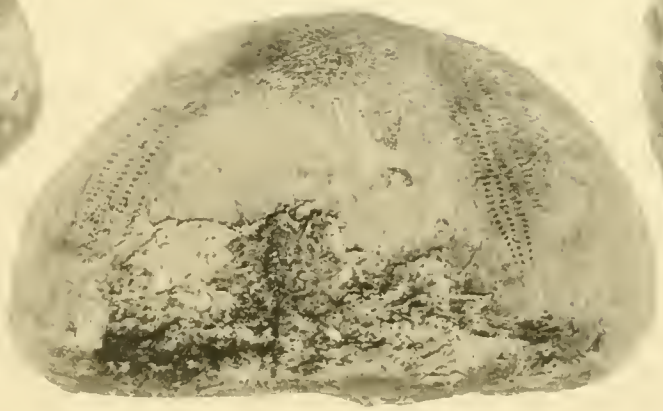
3



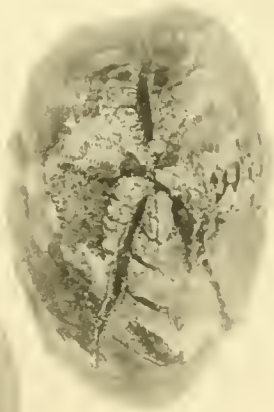
6



10



9



11

HELIOTYPE CO. BOSTON

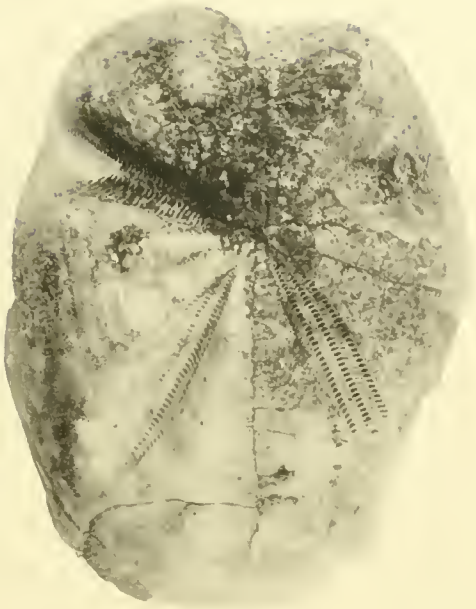
PLATE 15.

PLATE 15.

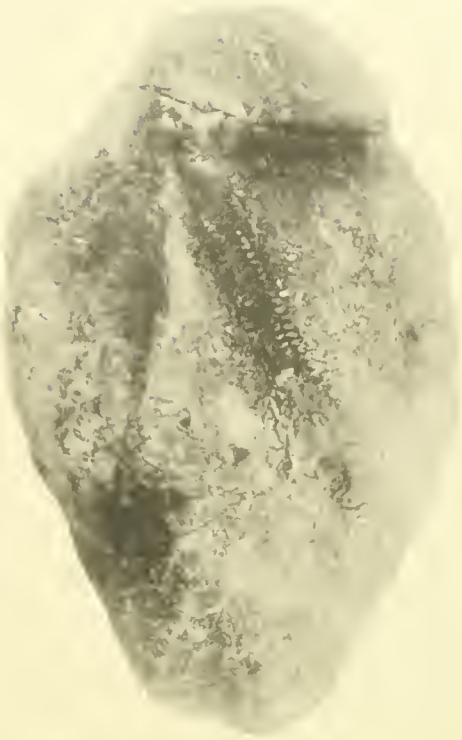
Fig. 1. Macropneustes angustus H. L. Clark.
Aboral view.

2. Meoma antiqua H. L. Clark.
Aboral view.

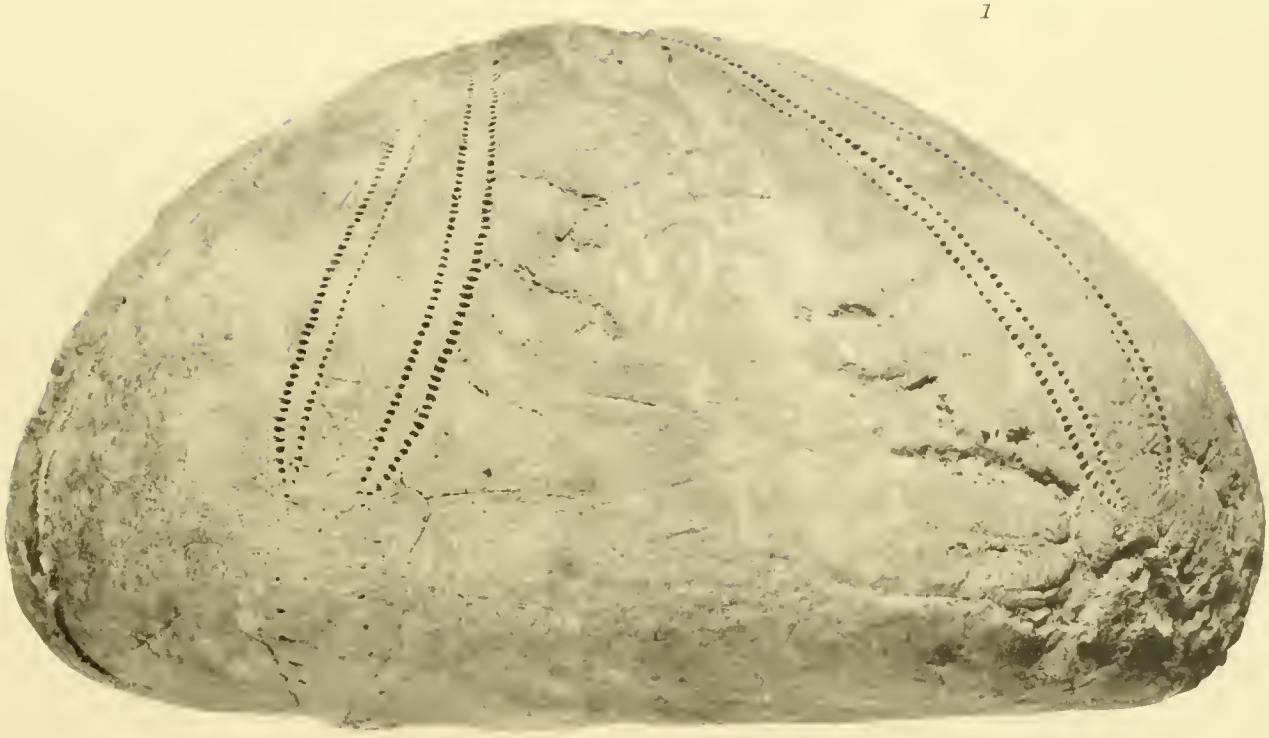
3. Antillaster arnoldi H. L. Clark.
Left-side view.



2



1



3

HELIOTYPE CO. BOSTON

PLATE 16.

PLATE 16.

Antillaster arnoldi H. L. Clark.
Aboral view.

HELIOTYPE CO. BOSTON

PLATE 17.

PLATE 17.

Antillaster arnoldi H. L. Clark.
Oral view.

HELIOTYPE CO. BOSTON

PLATE 18

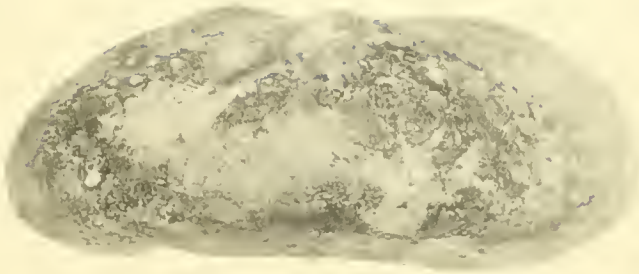
PLATE 18.

Fig. 1–3. Macropneustes parvus H. L. Clark.
1. Aboral view.
2. Oral view.
3. Left-side view.

Fig. 4, 5. Plagiobrissus abruptus H. L. Clark.
4. Aboral view.
5. Right-side view.

Fig. 6, 7. Plagiobrissus latus H. L. Clark.
6. Aboral view.
7. Left-side view.

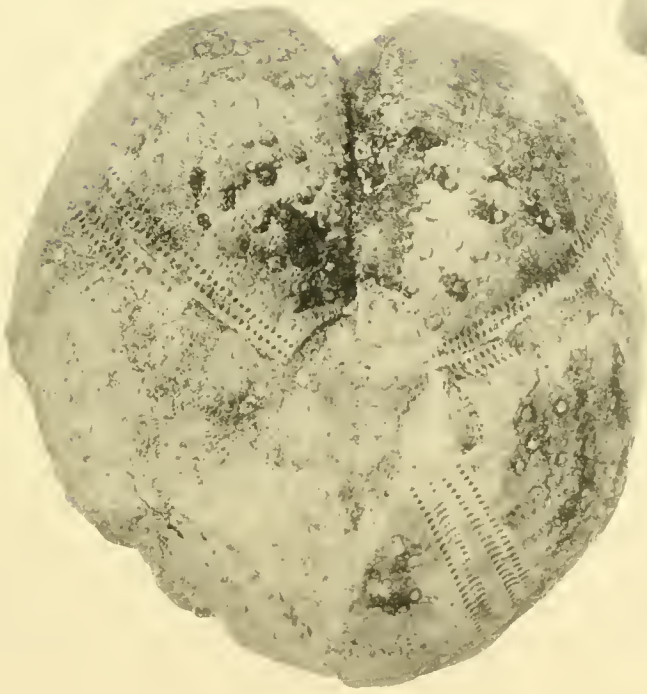
1



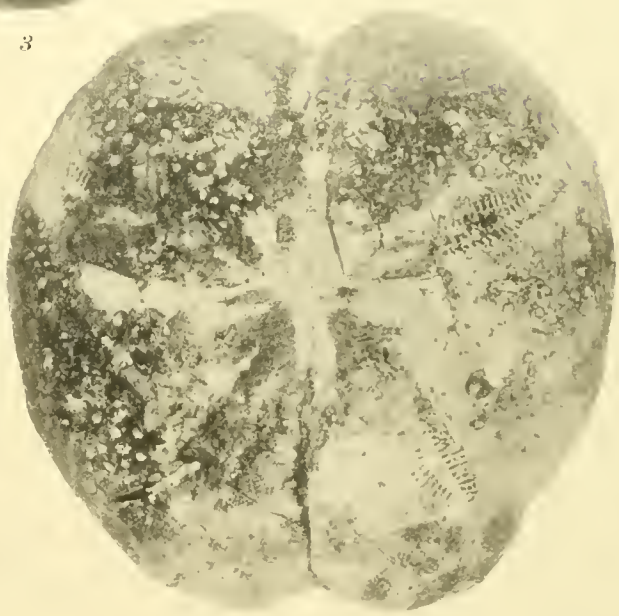
7

2

3



4



6

5

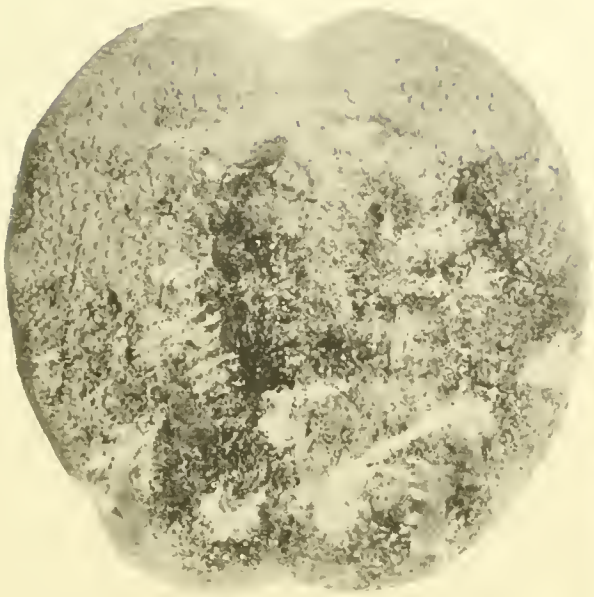
HELIOTYPE CO. BOSTON

PLATE 19.

PLATE 19.

Fig. 1. Plagiobrissus latus H. L. Clark.
Oral view.

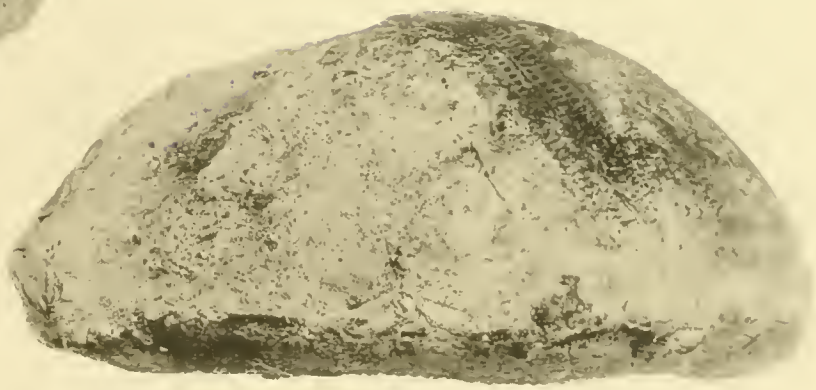
Fig. 2–4. Plagiobrissus elevatus H. L. Clark.
2. Aboral view.
3. Oral view.
4. Right-side view.



1

2

3



4

HELIOTYPE CO. BOSTON

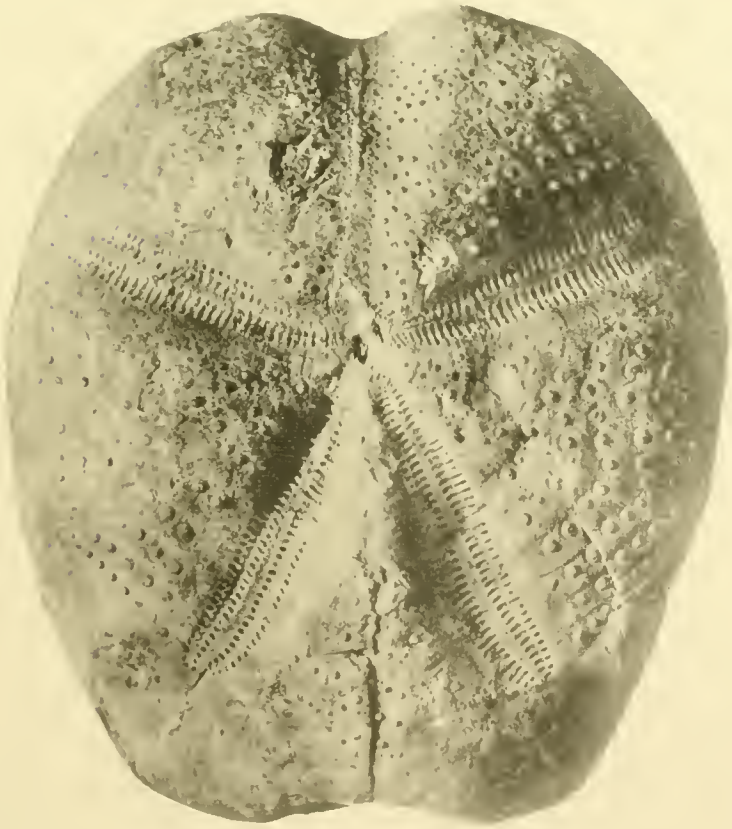
PLATE 20.

PLATE 20.

Fig. 1–5. Plagiobrissus loveni (Cotteau).
1. Aboral view of adult specimen.
2. Oral view of a small specimen.
3. Right-side view.
4. Aboral view.
5. Posterior view.

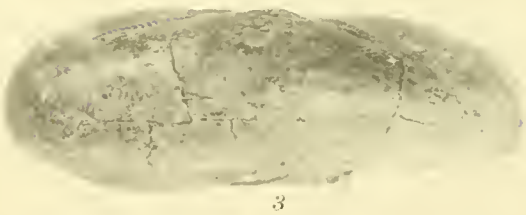
Fig. 6. Plagiobrissus perplexus H. L. Clark.
Right-side view.

Fig. 7. Plagiobrissus robustus H. L. Clark.
Left-side view.



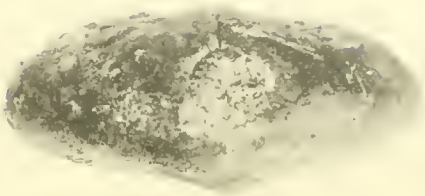
1

2

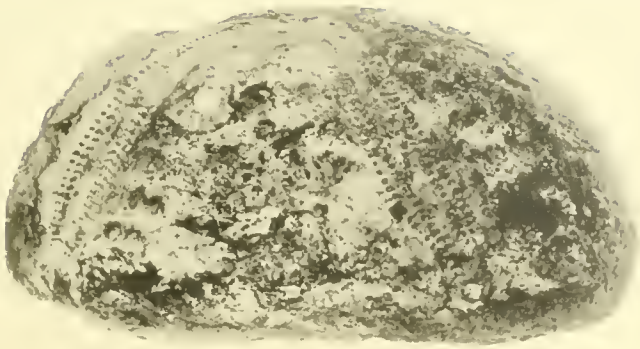


3

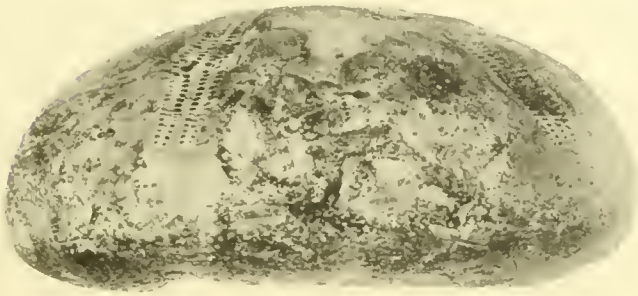
4



5



6

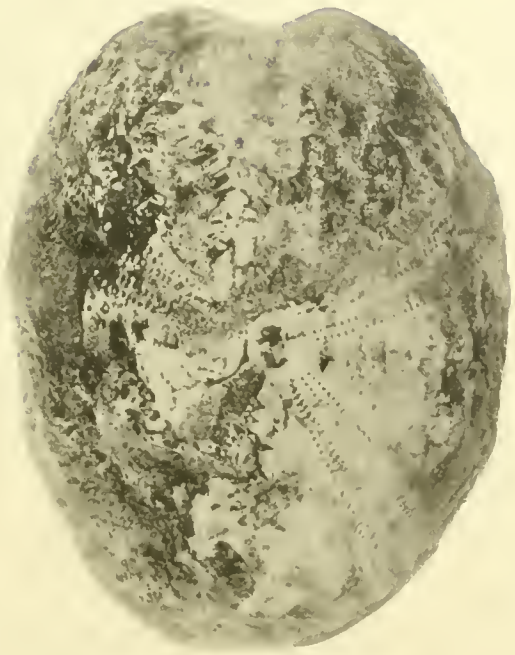


7

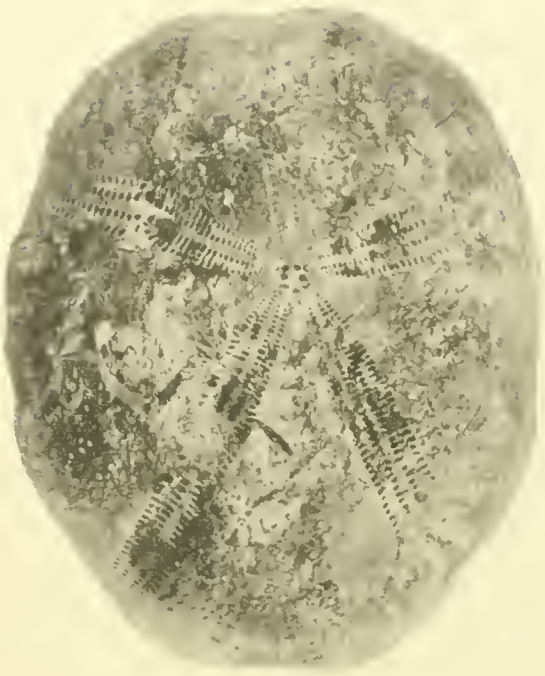
PLATE 21.

PLATE 21.

Fig. 1, 2. Plagiobrissus perplexus H. L. Clark.
1. Aboral view.
2. Oral view.
Fig. 3, 4. Plagiobrissus robustus H. L. Clark.
3. Aboral view.
4. Oral view.



1



3

2

4

HELIOTYPE CO. BOSTON

PLATE 22.

PLATE 22.

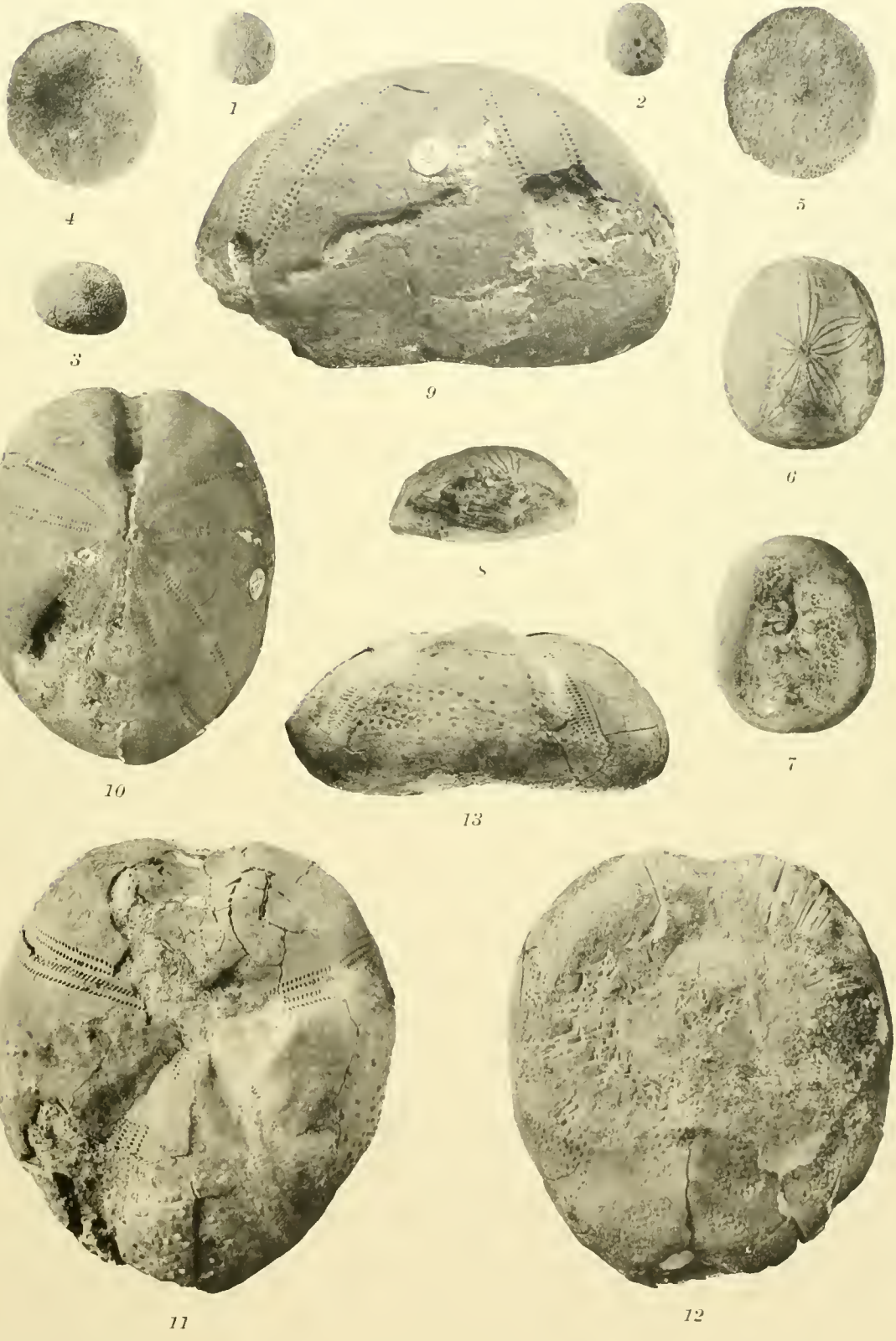
Fig. 1–3. Fibularia jacksoni Hawkins.
1. Aboral view. × 1.5.
2. Oral view. × 1.5.
3. Left-side view. × 2.

Fig. 4, 5. Sismondia crustula Hawkins. × 1.5.
4. Aboral view.
5. Oral view.

Fig. 6–8. Rhynchopygus matleyi Hawkins. × 1.5.
6. Aboral view.
7. Oral view.
8. Right-side view.

Fig. 9, 10. Eupatagus hildae Hawkins.
9. Right-side view. × $\frac{4}{5}$.
10. Aboral view. × $\frac{3}{5}$.

Fig. 11–13. Plagiobrissus loveni (Cotteau).
11. Aboral view. × $\frac{4}{5}$.
12. Oral view. × $\frac{4}{5}$.
13. Right-side view. × $\frac{3}{4}$.



1

2

4

5

3

9

6

8

10

7

13

11

12

HELIOTYPE CO. BOSTON

Harvard MCZ Library
2044 066 302 191

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE.

There have been published of the BULLETIN Vols. I. to LIV., Vols. LVI. to LXV. and LXVII.; of the MEMOIRS, Vols. I. to XLII., and also XLIV. to XLIX.

Vols. LV., LXVI., and LXVIII of the BULLETIN, and Vols. XLIII., L., LI., LII., and LIII. of the MEMOIRS, are now in course of publication.

A price list of the publications of the Museum will be sent on application to the Director of the Museum of Comparative Zoölogy, Cambridge, Mass.